

ENHANCING CUSTOMER EXPERIENCE
IN THE CONSTRUCTION INDUSTRY
A CASE STUDY FOR RAUTARUUKKI

HUANG, HAN-CHUNG
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Huang, Han-Chung

hanchung.huang@gmail.com
Tutor: Giulio Jacucci and Aarne Seppänen

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Abstract

In the recent trend of business strategy development and several design fields, enriching user experience has become the focal point for the innovative researches. This thesis attempts to address this issue, “how to enhance customer experience in the construction industry,” through a case study of Rautaruukki Construction Division. It is a business-to-business relationship between Rautaruukki and its customers. How to develop and enhance user experience in this context is the objective of the thesis.

The research will produce the result in the form of a interaction design guide for Rautaruukki’s software applications of steel building design. It will indicate the method for developing user experience of software through empirical study and literature review. Furthermore, it will attempt to give insights for other companies also in the B2B business sector.

Keyword: User Experience, Interaction Design, Web Service, Business-to-business Relationships, User Interface

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PART A. FROM USER EXPERIENCE TO MODEL SOFTWARE

1 Introduction

1.1 Introduction

“Welcome to the experience economy” said B. Joseph Pine II and James H. Gilmore, both advocates for the emerging era of the experience economy (Pine & Gilmore 1998). Since then, “experience” has become the most popular buzzword, and has inspired researchers, designers and managers from different fields to join forces to conduct studies and produce innovations. In the business practice of interactive product, software, and service design, companies are increasingly keen to develop unique values for their products and services to customers in order to improve customer experience.

This phenomenon can be widely seen in the consumer-oriented business sector. Companies stage experience whenever they engage customers in a personal or memorable way (Pine & Gilmore 1998). Through different approaches of providing better user experience, companies have successfully increased business revenue and built up stronger connection with customers. However, in the business-to-business sector, it is not yet understood how to enhance user experience during company-to-company interaction.

This thesis attempts to discover how to enhance customer experience in business-to-business interactions through a case study for Rautaruukki Oyj (hereinafter “Ruukki”). Ruukki is a Finnish company that works in the metal and construction industry. Ruukki Construction Division provides products of steel building material, and related services to their customers. During past two decades, Ruukki’s software has been developed to improve customer service. However, the interface of these software applications is becoming old and inconsistent due to the long development history. The task assigned by Ruukki is to reinvigorate the design of the user interface for the future updates of these applications.

1.2 About Ruukki

Ruukki Construction Division provides building material products, including building frames, wall and roofing products, and integrated systems for single- and multi- storey construction. It also provides construction consulting and planning service for a variety of different customers. In this business-to-business sector, Ruukki works with many groups including investors, building engineering consultancies, architecture companies, and construction companies, who work on building design and construction projects.

Software applications developed by the Business Development Unit have been playing an important role in this industry. They are the supportive tools that help Ruukki’s customers proceed with structural design and architecture design projects, amount and cost calculation of materials, product ordering and tracking. Although Ruukki’s software is not its major merchandized product, Ruukki and its customers benefit from the business interactions enabled by these applications.

Currently, Ruukki has developed about twenty applications and around half of them are commonly used in the steel structural engineering field. For instance, ComCol, ComBeam, and ComSlab applications are used during the design phase for materials, like columns,

beams, and slabs. Figure 1-1 shows the interface of ComSlab. ComSlab is capable of designing, conducting a load analysis, and conducting amount and cost calculations. These applications are recommended for use in design work by the Finnish Constructional Steelwork Association and they are commonly adopted in steel design work in Finland.

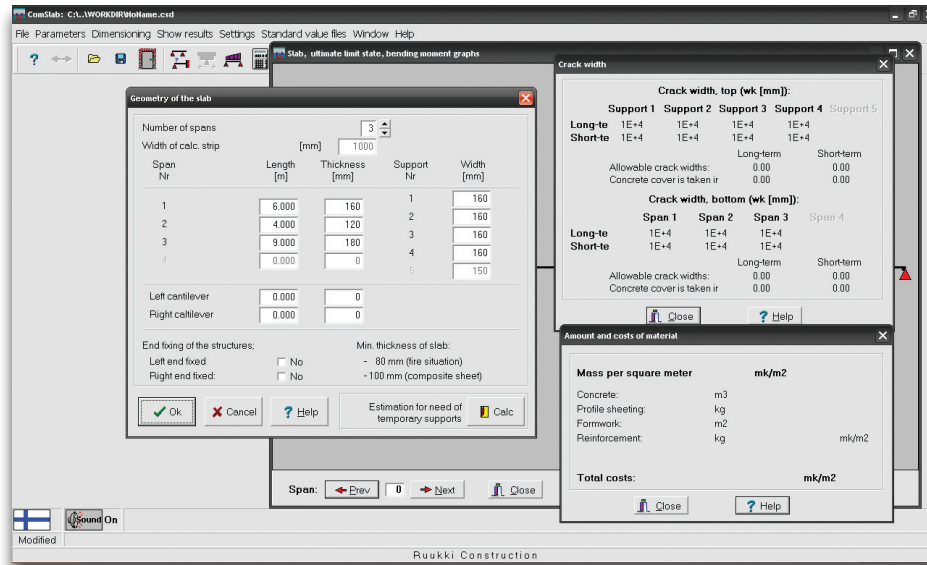


Figure 1-1 ComSlab is the application for designing steel composite slab components.

1.3 Thesis Objectives

The objectives of this thesis study are:

- 1) To discover an approach of enhancing customer experience in the business-to-business sector.
- 2) To provide success factors and insights for organizations in similar situations to Ruukki.
- 3) To produce the research results in the form of a design guide for Ruukki's software.

1.4 Thesis Structure

This thesis has been divided into three parts. The introduction establishes the research context and objectives. The second chapter presents the background study of Ruukki, Ruukki's software, and other software in the building design and construction industry. The third chapter introduces the theoretical context of this thesis, research methods, and a user study, which help to identify key elements of the *Design Guide for Ruukki's Software*.

The second part of the thesis presents the outcome of the design guide for Ruukki's software. Design Guide of Ruukki's Software includes an introduction for users that outlines the guide and its benefits. The Design Guide also outlines the value of Ruukki's software, the technology for implementation, and how to construct a user interface to match the users' behavior.

The conclusion of the thesis composes the third part, and responds to the objectives of this thesis.

2 Background Study of Ruukki's Software

2.1 Software in the Construction Industry

In the building design and construction industry, software applications used as productivity tools, can assist with building design, documentation, communication, project management, ordering, or transactions. In order to provide the best advice and recommendations, the software discussed in this thesis will focus on applications developed to be used by personnel in this industry. For example, this excludes Office applications like Microsoft Word and Excel.

There is a vast amount of software applications related to building design and construction, which includes high-level and expert applications like BIM (Building Information Modeling) applications but also unsophisticated and compact applications designed for basic tasks like calculation of material needs.

Most of software applications are used in a desktop PC environment. However, with the immense changes that Internet technology has brought to software development, more and more applications are now integrated with Internet-connecting features or are created as genuine web applications.

	Name	Function	Platform
1	WinRami	Analysis and design tool for truss and frame	PC
2	ComBeam	Composite beam design	PC
3	ComSlab	Composite Slab design	PC
4	ComCol	Composite column design	PC
5	Poimu	Load bearing sheet design	PC
6	PurCalc	Light weight purlin design software	PC
7	TrayPan	Panel and liner tray design	PC
8	Ruukki Tool set	Object library of Ruukki components for Tekla Structures 15.0	Software add-on
9	My Orders	Component sales service	Browser-based
10	Ruukki.com	Rautaruukki's website	Browser-based

Table 2-1 contains a summarized list of Ruukki's software including their names, functions, and operating platforms.

The table above lists several steel design applications and web-services provided by Ruukki. Ruukki's software can be divided into three main types: steel design applications, object libraries for BIM applications, and web-services. Based on the model of Ruukki's software, there are three main categories presented in figure 2-1 to illustrate differences in the software used in the construction industry. The categories include: expert applications, native applications, and web applications. The grouping is also based on the complexity of the application's functions and features. These categories will be explained further in

Chapter 2.1.1, 2.1.2, and 2.1.3.

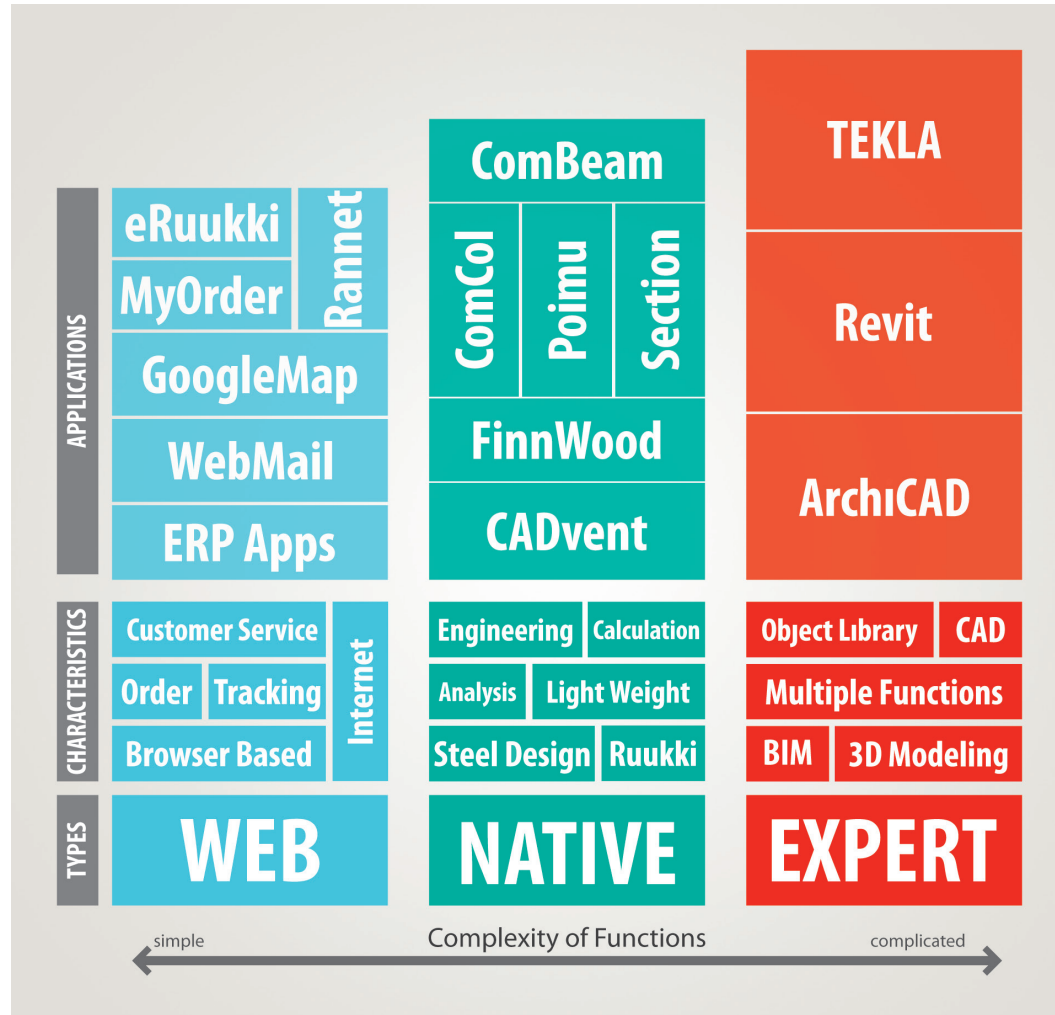


Figure 2-1 Software applications used in the building design and construction industry

2.1.1 Expert Applications

Expert applications in the building design and construction industry are usually referred to as Building Information Modeling (BIM) applications. In Finland, most architects and structural engineers use Autodesk's Revit, Graphisoft's ArchiCAD, and Tekla Structures from Tekla. BIM applications have been developed to enable real-time building design modeling, and they apply three-dimensional modeling technology. BIM applications are modern technologies that enhance

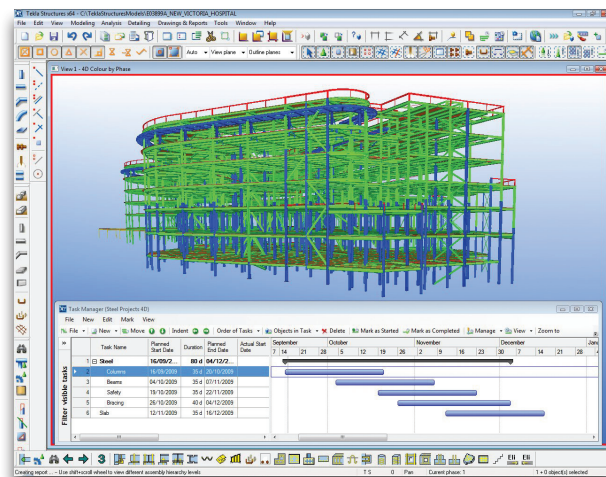


Figure 2-2 Tekla Sturcutre from Tekla

productivity and accuracy of building design.

Architects and structural engineers use these applications as an important production tool during the design phase. Compared to traditional work of 2D construction plans, section maps, and elevations, BIM applications create real-time 3D models and generate documents including rendered pictures, 3D object files, and structural design plans. These documents are used as communication tools and detail execution plans for building construction.

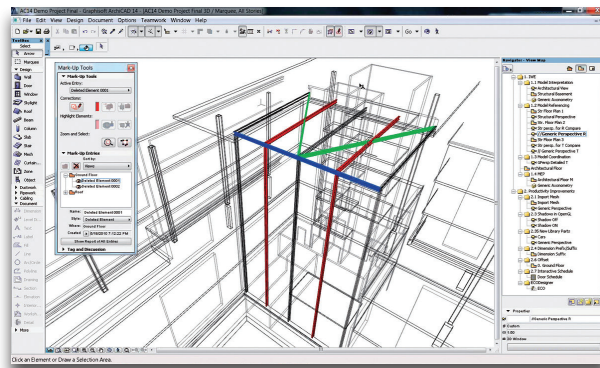


Figure 2-3 ArchiCAD from Graphisoft

BIM applications are constantly being developed and released by professional software companies. Most of them have built-in features that allow users to create own component libraries. Currently, Ruukki offers three-dimensional object files of its building components for Tekla Structure and ArchiCAD. The three-dimensional object files contain dimensional data and technical specifications, and they can be imported to component libraries for architects and engineers to use instantly in their designs. Figures 2-2 and 2.3 show the interface of Tekla Structure and ArchiCAD.

2.1.2 Native Applications

Native applications are the applications that Ruukki has focused on and developed the most in the past. Examples include ComBeam and ComCol, which are designed to calculate the capacity of load and deflection in structures, select suitable beam or column products, and summarize the amounts required.

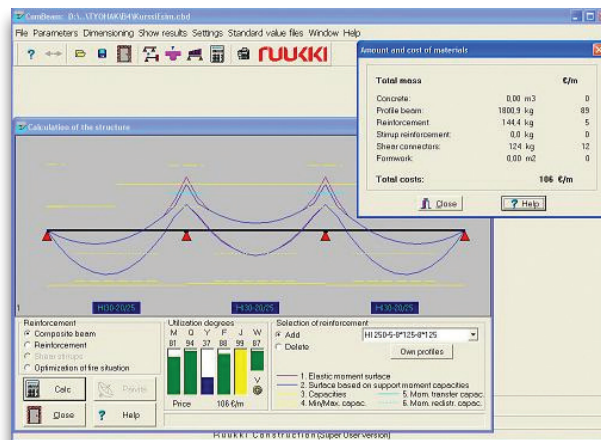


Figure 2-4 ComBeam from Rautaruukki

Many material vendors like Ruukki have their own applications suited to their products; for example, ventilation design, wood structure design, or electricity design. Compared to BIM applications, these applications are easier to use for development and maintenance. Mainly, material vendors develop

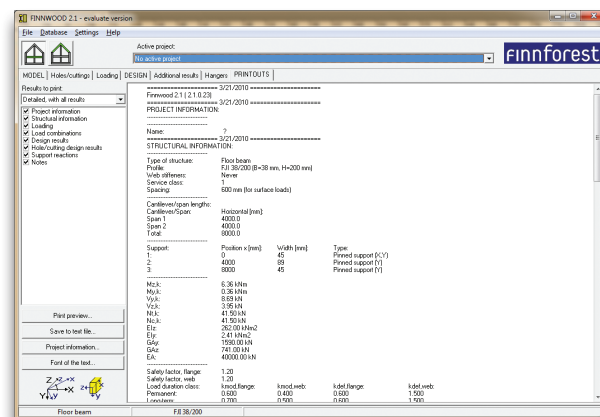


Figure 2-5 Finnwood from Finnforest

software internally; however, sometimes they require the assistance of outsourced contractors. Figure 2-5 shows the interface of Finnwood for wood building design from Finnforest.

Core users of these applications are engineers. They use these applications as intermediate tools after receiving design requirements and before working with BIM applications. The applications provide supportive information for them, to assist in deciding which components products to use in their design.

2.1.3 Web Applications

The third category is a wide and loose collection of applications enabled by Internet technology, for example the protocols based on XML (Extensible Markup Language) like Single Object Access Protocol (SOAP), Web service Definition Language (WSDL), and Universal Description Discovery and Integration (UDDI). These applications are usually operated on web browsers, and users can access them without needing to install the application on their own computers. These applications typically aim to provide customer relationship services such as product ordering, order tracking, and product information exchanging.

Web applications generally have simpler program codes. They can be developed separately and aggregated together to be distributed through a single online portal. They are capable of sharing the same database, and can be revoked instantly at a user's request, without installation on any particular computer platform. In fact, these applications can be used on most devices with Internet access, including smart phones, PDAs, and eBook readers. The proliferation of this development trend is a result of a consumer-oriented industry.

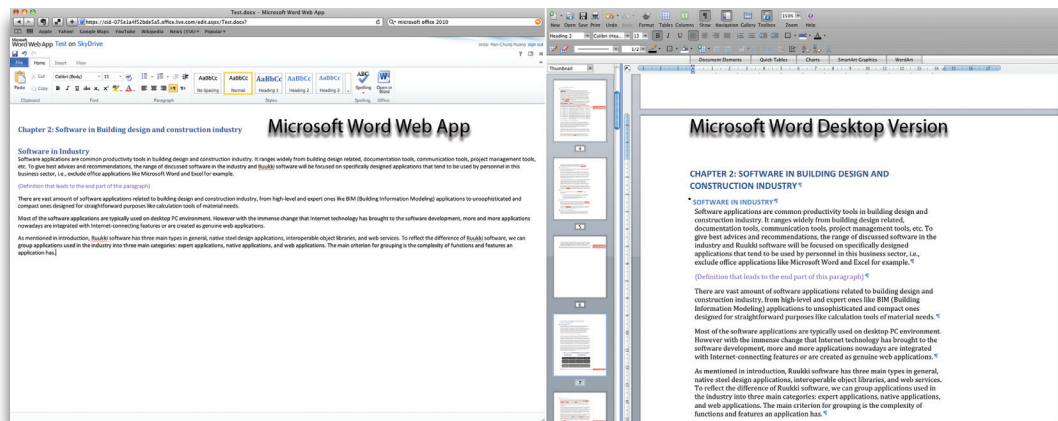


Figure 2-6 Browser version of Microsoft Office 2010 showing its ability to provide multi-platformed access

For instance, social media companies have been fully committed to developing web applications such as Facebook, Twitter, and Foursquare. These applications allow users access to services on multiple platforms. Other personal productivity tools like Evernote and Dropbox also provide functionality across platforms including PCs and Smartphones, by using the Cloud-storage feature that automatically saves and synchronizes users working files between devices.

The new version of Microsoft Office 2010 has embedded features of web applications to allow users to edit various documents on web, synchronize their saved data, and enable access to the data no matter which platform they are operating. Figure 2-6 shows the interface of Microsoft Word Web App.

Currently Ruukki offers four different web services on Ruukki's website. They are mainly focused on giving customers services of ordering, tracking, and product information. With the maturity and rapid evolution of the web application field, these applications give the best potentials for Ruukki's software and benefit to Ruukki's customers.

2.2 Goals, Contexts, and Challenges of Ruukki's software

Goals

The focus of Ruukki's business strategy, taking into consideration keen competition in the construction industry, is to improve its products and services in order to provide positive experiences and a high-level of satisfaction to customers, which will help to establish strong working relationships and customer loyalty. In a broader sense, Ruukki's building products, services, and software applications are based on a similar model of customer satisfaction that helps to create value in its services. As a result, the most important task for Ruukki's software is to be strategically planned and designed, and to be accompanied with products and services based on a systematic approach. Furthermore, the study of business strategy also shows a recent trend of offering solutions to customers instead of stand-alone products. Companies following a solution strategy bundle their products together, and include software and services (Galbraith 2002). Kapil Tuli (Tuli et al. 2007) further elaborated that "customers view a solution as a set of customer-supplier relational processes comprising (1) customer requirements definition, (2) customization and integration of goods and/or services and (3) their deployment, and (4) post-deployment customer support, all of which are aimed at meeting customers' business needs."

To consolidate this comprehensive solution, the goals for Ruukki's software can be summarized in the following points:

- 1) To discover what customers will need to operate their business.
- 2) To create a system of software applications responding to these needs.
- 3) To develop the appropriate interaction between software and customers.

The term "software system" refers to the combination of different software applications, data, and enabling technologies (Beyer & Holtzblatt 1998). It outlines how to design a customer-centered system in software development.

Context

Ruukki's software is not the company's major means for gaining business profits; instead, it is a supplementary service to provide customer support for the steel building component products and the services it offers. For customers, these applications are the face of Ruukki's services, which they interact with on a day-to-day basis. Consequently, interaction through the software is the key element to successfully link the business operations of Ruukki to

its customers. Through this connection, Ruukki can share business knowledge, operational needs and requirements, and technological knowledge of steel materials.

Figure 2-7 shows an example of a current inadequate interface of Ruukki's software attributed to the age of the program.

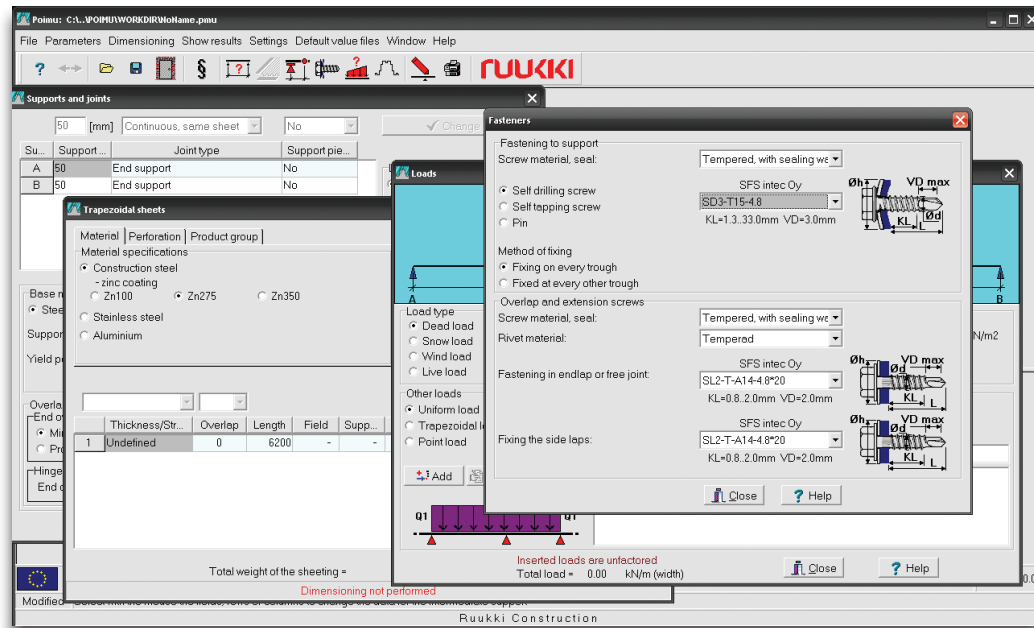


Figure 2-7 Burden inhibited inside the interface of Poimu. Overlapping function windows decrease usability of the software and create interruptions in the users' working flow.

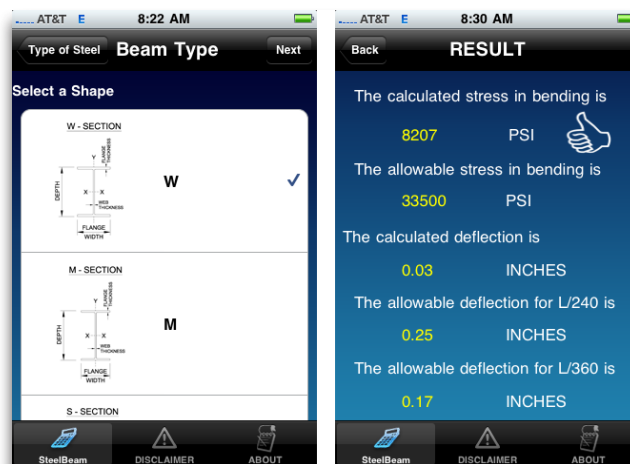


Figure 2-8 Steel Beam Design app from Construction Knowledge .net (<http://www.constructionknowledge.net/>): a cross-platform smart phone application (iPhone, Android phone, and Blackberry). It exemplifies the possibility of creating multi-platform engineering design applications and enabling a modern approach of distributing applications through a mobile online application store (i.e. App Store, Android Market, Blackberry App World).

The Internet-age has brought various technologies and new insights that affect current trends of software development, and reshape the software development field in many ways. Internet provides opportunities to developers to overcome the difficulty of distributing applications to potential users, and it creates heterogeneous accesses. The Internet provides multi-platform and interoperable data for existing users to perform their tasks in the way they want and the time they want (Weil 2007). Figure 2-8 shows an example of this kind of innovation: a mobile application of Steel Beam Design that can be used on an iPhone.

Challenges

There are several challenges for the development of Ruukki's software that reflect the company's goals and the context of their software development. For Ruukki's customers, the core benefit of using these applications is to simplify their daily business operational needs like architecture design, structure design, project coordinating, and product ordering. The first challenge is how to create applications that will fit into the customers' working processes. The applications are not designed for a single workings process, but rather the whole working system that includes the working processes of all participants in the construction industry.

Since Ruukki's building products and services are its main business offerings to the customers, the second challenge is how these applications can be designed to contribute to the product sales, increase service demands, and provide the supportive information and knowledge.

Third, there are many applications in need of maintenance and upgrades. How to develop Ruukki's software in a time-efficient and resource-effective manner remains a critical issue. Software development, by nature, is an inherently people-oriented discipline that cannot be reduced to purely mechanical and deterministic processes (Greenfield & Short 2003). Limited resources make it difficult to create new applications, while continuing to maintain and update old ones.

The last challenge is how to sustain consistency in terms of the brand image, functionality, and interaction across the different applications that Ruukki offers to its customers. It is also important to minimize the challenges of learning Ruukki's software for both existing and new users. This challenge is directly related to the user interface and the interaction design of the software, i.e. how to create constant and coherent interactive behaviors across different software applications.

3 Research Process

3.1 Theoretical Study of Experience

In the business-to-business sector, experience of customers is based on customers' engagement of companies' business solutions, product offerings, information services, customer relationship management and software applications. To conduct this thesis study, the discussion of experience refers to the user experience of software applications.

User experience of software applications is mainly based on user interaction with the software interface. The user interface consists of a physical medium (software applications, personal computers, or digital devices) and the content presented through the medium (Baecker 1995). Interface elements impact the experience of consumers interacting with a retailer's product offering, and can determine the level of interface involvement. Interface involvement is the ability of a user interface to facilitate user involvement with the material presented through the interface (Reeves & Nass 1996). Higher interface involvement increases user engagement with retailers' offerings or other information presented. Consumers more actively process information when there is increased consumer involvement with the retailer's product offering (Petty & Cacioppo 1979). This leads to a more positive consumer response in terms of attitude, product evaluation, and shopping intentions (Griffith et al. 2001). Thus, software interfaces can invoke positive responses and further engagement with business offerings during business-to-business interactions, and are an important aspect of user experiences.

To develop user experience, there are three overlapping concerns: form, behavior, and content, as figure 3-1 illustrates (Cooper et al. 2007). Form is created by industrial and graphic designers, and dictates how the product looks physically, while information architects and other personnel tailor the content of a product or a service. Interaction designers design the behavioral attributes that dictate how the content is delivered and connected to its form.

Jesse Garrett describes (Garrett 2000) five elements for developing user experience: "strategy, scope, structure, skeleton, and surface". The elements move from an abstract level to a concrete level, as figure 3-2 shows. The strategy for developing user experience requires an outline of what users need and what a company wants to achieve through the distribution of the application. "Scope" is an outline of the functionality and the technology specification for user experience. "Structure" is the transitional element between abstract and concrete. "Interaction design" is the structure that transcribes strategy and scope into the concrete level of user experience.

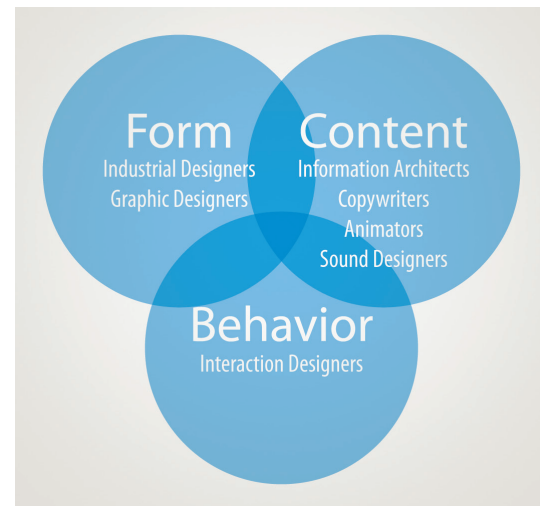


Figure 3-1 There are three overlapping concerns for developing the user experience of digital products (Cooper et al. 2007).

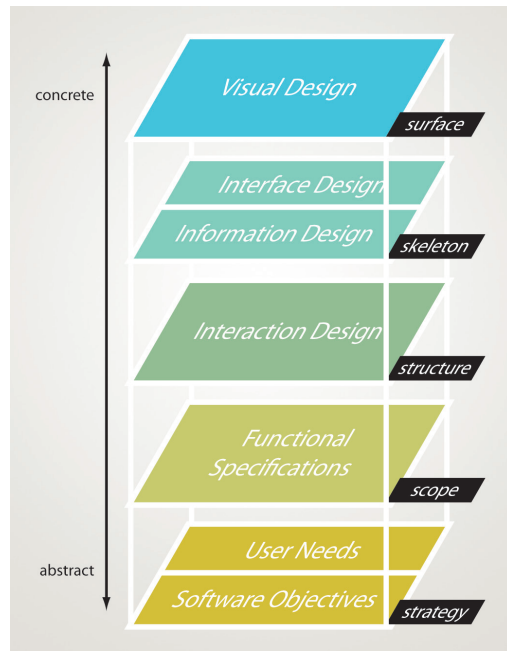


Figure 3-2 The five elements of user experience (Garrett 2000)

Among these elements and concerns, it is easy to be confused by the overlap between interface design and interaction design.

The Interaction Design Association describes interaction design as a discipline that defines the structure and behavior of a system (<http://www.ixda.org/about/ixda-mission>). The development of interaction design is based on an understanding of users and cognitive principles (Cooper et al. 2007). When designing a computer-based system or device, it is not just about the physical appearance but its behavior. Developers design the quality of how users interact with the system. This is considered to be the main purpose of the interaction designer (Smith 2007). As a result, the difference between

interaction design and interface design is that the former focuses on the study of user behavior and the construction of

the structure of a system of different software. In contrast, interface design focuses more on the structure of visual elements and detail design.

Combining Alan Cooper's three concerns and Jesse Garrett's five elements, this thesis will focus on the abstract elements of strategy, scope, and structure. The thesis will not focus on the concrete elements mentioned in Figure 3-2, since visual design (form), interface design and information design (content) vary depending on implementation. The literature review of the three elements will be integrated into the chapters that follow.

Besides a literature review of the topic, the underlying approach for the empirical study of this thesis is "Goal-directed Design," an interaction design approach advocated by Alan Cooper (Cooper et al. 2007). Goal-directed Design consists of a series of design activities, which are very similar to user-centered design but have a stronger focus on objectives in software development and interaction design. It begins with an exploratory context study of users' activities, business intentions, and technological constraints. Then, designers and developers conduct a user study, produce personas and scenarios, and finally apply these studies to the requirements and specification of software applications. With these requirements, designers are able to establish a framework for a user interface, and develop their design work accordingly. These activities are all based on a primary concern for user satisfaction. As Alan Cooper described, a goal is an expectation of the end condition that can be achieved through appropriate activities and approaches. This goal-directed approach differentiates the process of digital product design from the conventional task-oriented approach that often yields inadequate results and doesn't satisfy users.

3.2 User Study

3.2.1 Contextual Inquiry

The objective of this user study is to understand the background of users, their use of software, and their relationships to the construction industry. The study in this thesis attempts to identify the users' goals while using software, especially the user's business goals, organizational goals, and individual goals, both in daily business operations and through interaction with Ruukki's software. The study also depicts the working process of individuals and of larger industries, since that is an area where a good application and interface can directly contribute customer experience. The method for conducting the user study is based on the "context inquiry" method developed by (Beyer & Holtzblatt 1998).



Figure 3-3 User interview in private office

The user study in this thesis is separated into two major parts. The first outlines the internal interview that was held at the Ruukki Construction Division with personnel from departments including product development, customer relationship, sales, and marketing. The second part summarizes external interviews that were held with structural engineers, managers, and architects, Ruukki's business partners and customers.

All interviews were held in the interviewees' personal working environment. A set of questions was read, while using voice recorder for audio recording. There were also three groups of graphic materials shown to the interviewees. The questions dealt with the interviewee's working environment: the people they work with, the tasks they perform, and their desire and avoidance of tasks. The materials used during the interviews were supplemental, and meant to help interviewees articulate their ideas; the users expressed their opinions by arranging the materials and presenting them to the interviewer. Another



Figure 3-4 Materials for interview: image collages and other paper materials for interviewee to depict their contextual information

material provided during the interview was an image collage of different software applications used in the construction industry. The collage helped the interviewees describe their opinions on current software they were using.

The interviews started with a short introduction of the purpose of the interview and a clarification of terminology used in the questionnaire. Then went through questions of tasks they perform, people related to their work, their personal aspiration and avoidance of their work. The last part of the interview was an open discussion about the experience when using software applications in their professional daily life.

3.2.2 Analysis and Interpretation



Figure 3-5 A visual map to show the comprehensive data of one interviewee

After the interviews, the recordings were transcribed and categorized. The essential information gathered from each interviewee was extracted and used to create a visual map as Figure 3-5 shows. The information on this map was interpreted and classified into “goals (personal and work-related)”, “tasks”, and “tips.”

Goals and tasks were identified because they are the fundamental elements of why users require the applications and what they hope to achieve by using the applications.

It can give developers a deep

understanding of how software can be improved to match users’ working processes, and how user experience can be improved by serving goals and tasks of users. The third category, tips, refers to insights and knowledge gained from users that can be used to develop a new perspective on how to improve Ruukki’s software.

3.2.3 Outcome of User Study

After identifying goals and tasks, data from each interviewee was compared in order to find similarities and differences between different players in the construction business sector. This information was further synthesized into several user study results.

The first result is a persona-style, context description of customers. As figure 3-7 shows, this description includes a simple profile of the individual’s employment position, familiarity with software, goals, typical tasks, and individual tips. The results will be elaborated in Chapter Seven to describe how to create a proper software interaction.

The second production result of the user study is a map that depicts how building design and construction projects proceed in the construction industry. The map divides the whole process into three steps: planning, designing, and constructing. It shows the involvement of different players in the process, and their interactions and interrelationships, as figure 3-8 shows. This map is used in Chapter Five to depict the working processes of both customers and Ruukki, with the goal of discovering what will be beneficial to their daily business operations.

The third result is the map of workflows of architects and engineers that is depicted in figure 3-9. This map contains detailed information acquired during the user study. Currently, architects and engineers are the main users of Ruukki's software. The results will contribute to Chapter Seven, Interaction Design for Ruukki's Software. The map shows the details of architects' and engineers' work in different phases of a building project. It also depicts the links between their works.



Figure 3-6 Process of interpreting user data

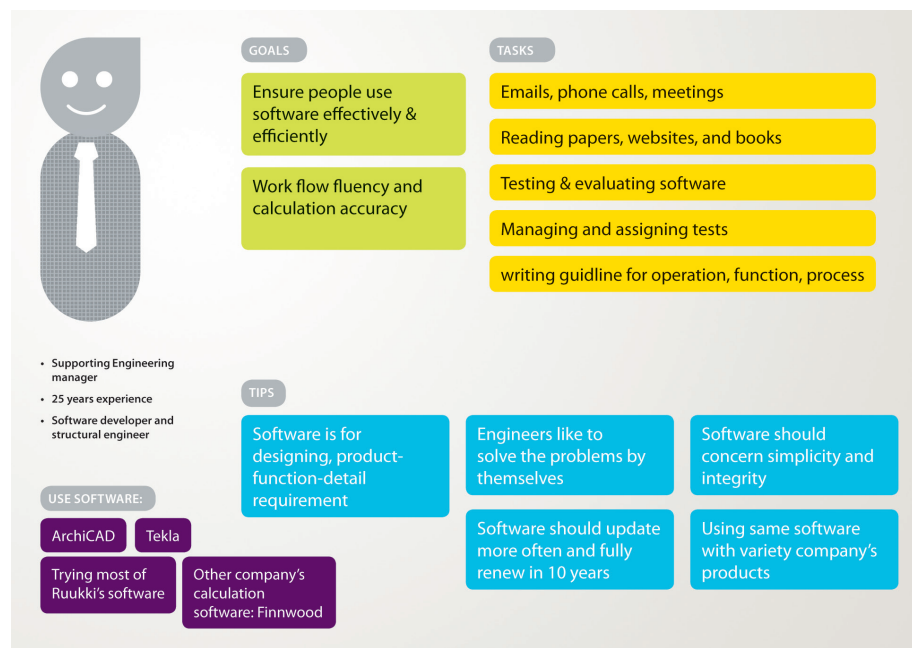


Figure 3-7 One page of the user study report: a persona

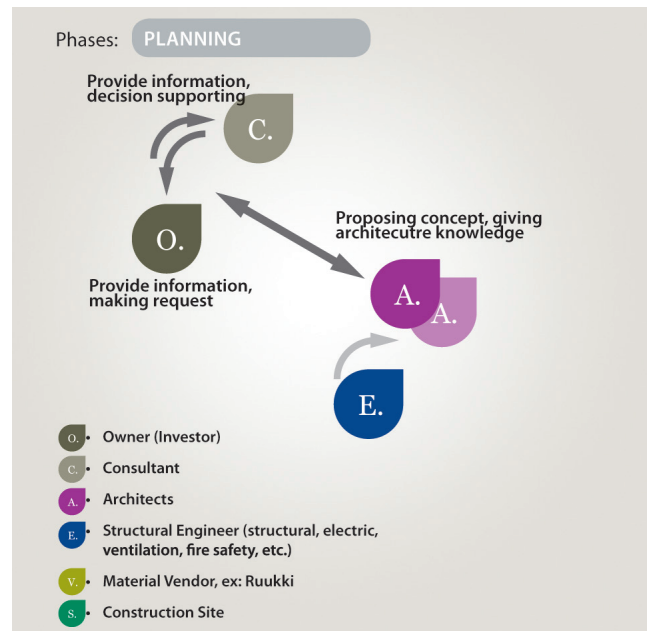


Figure 3-8 Players and the relationships in a building project

The user study gave solid contextual information about Ruukki's software and the construction industry. The data is essential to show how customers use software applications, and to indicate how their work can be improved. This information has contributed to different parts of the research. First, it provided solid criteria to interpret what users need, and valuable services that could be offered by Ruukki's software. It describes the goals and tasks of customers, and it furthers development of the design strategy to enhance customer experience with software. Second, based on the design method of Goal-Directed

Design, persona and task analysis of the results from the study are used to further the understanding of how the interaction design for Ruukki's software can be created.

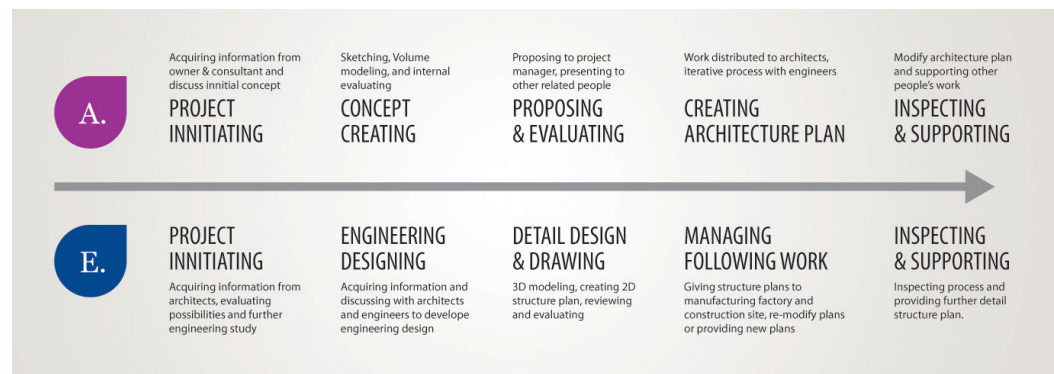


Figure 3-9 Working process of architects and engineers in a building project

3.3 The Production of the Design Guide

The findings of this chapter show that there are three essential elements for creating user experience: strategy, functional specification, and interaction design. By combining the principle of Goal-Directed Design and user study, to identify users' goals, tasks, working process, and interactions with other users, it is possible to determine what users want, what technology should be applied, and how to create the ideal interaction experience.

This thesis uses these findings to demonstrate the approach of creating user experience. Figure 3-10 shows that it begins with a user study and follows three steps: creating user

experience, strategy, technology, and interaction design. This process will be applied as a starting-point for Ruukki's software, a design guide.

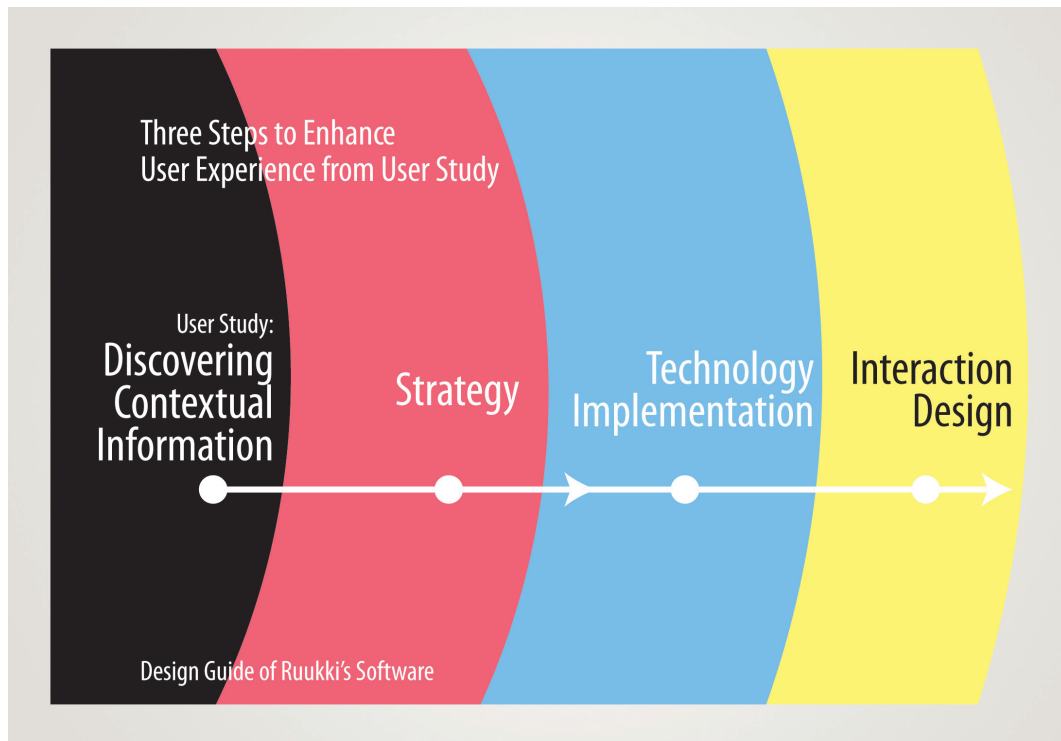


Figure 3-10 From user study to the three steps of creating user experience

If we see Ruukki's various software applications, digital data, and the interaction between applications as a software system; improvements to this system are the goals of the design guide. The challenge of developing software is keeping customers' work coherent, so the software system can support its user's expectations, while extending and transforming the business operations and software system's vision (Beyer & Holtzblatt 1998). The design guide of Ruukki's software aims to improve the overall user experience of this software system.

PART B. DESIGN GUIDE OF RUUKKI'S SOFTWARE

4 Design Guide of Ruukki's Software

4.1 About the Design Guide of Ruukki's Software

This guide has two main focuses: the framework of Ruukki's software and the Goal-directed Design approach.

This system framework starts with the explanation of users' individual working processes and the interaction between users. The working process acts as threads fabricated into the framework that provides the abstract of architecture inside Ruukki's software. It aims to shed light on the hidden structure by displaying three different layers of this system: the value system enabled by Ruukki's software between businesses, its building blocks of technology, and the interaction between users and Ruukki's software.

The Goal-directed Design approach provides fundamental knowledge of users from the fields of cognition engineering and interaction design. It also describes an example of developing user interface that is based on goal-directed and process-oriented principles to contribute to the development of a software system and its interaction with users.

These two focuses serve the same purpose, of creating a system of software applications that respond to customers' requirements coherently and match customers' working processes. Thus, Ruukki's software can enrich customer experience and maximize its positive effect on Ruukki's business in this business-to-business sector.

4.2 Benefits

This guide provides three benefits to Ruukki's software development:

- 1) It indicates the core business value of Ruukki's software.
- 2) It depicts the necessary infrastructure of the system of Ruukki's software for development of coherent applications corresponded to customers works.
- 3) It provides an instructional example for developers to use when creating the user interface of applications.

4.3 For Whom

This guide is developed primarily for developers including software engineers, interaction and interface designers, and strategic planners at Ruukki. The guide for creating a coherent structure for software will benefit the development process. Also, by using the Goal-Directed Design approach, customer need will be better understood; consequently, this will provide clues how customers needs can be addressed during software development. The design guide will also be delivered to out-sourced contractors for a quick orientation to Ruukki and its customers to enable the creation of user-centered and holistic software applications.

4.4 The Organization of the Guide

This guide comprises three main chapters, an introduction and suggestions for future development. Chapter Five is the elaboration of the design strategy of Ruukki's software. It explains the importance of creating a coherent system of software applications by explaining the users and their needs. It also explains the values of Ruukki's software by displaying the interactions between Ruukki and its customers in this business-to-business sector. Chapter Six introduces the technology that can enable the software system that enhances user experience. It constructs a conceptual framework from the technological aspects of Ruukki's software. Chapter Seven introduces the approach of interaction design and provides an example that demonstrates the development process of the interface of Ruukki's software.

5 The Design Strategy for Ruukki's Software

5.1 The Meaning of Ruukki's Software to the Business

From the perspective of business-to-business interaction, the role of Ruukki's software is not simply a collection of software programs. It acts as a broker between Ruukki's business and customers' business. It delivers services through the functionality of the software and provides tools to assist customers in the execution of their work. These home-grown applications enhance business agility by connecting business processes of different companies in the industry (Mike P. Papazoglou & Heuvel 2007). The contribution of Ruukki's software is its ability to help the business operations of Ruukki and its customers. It also enables the business interactions to take place between both parties in a virtual space.

The way Ruukki's software contributes to the business can be seen as a value-creation process. Ruukki and its customers do not benefit from the purchase and the sale of the software, but rather from using software and interchanging knowledge and skills of building materials and construction. A company adds values to its business offerings for customers by arranging its intangible resources (knowledge and skills) (Brohman et al. 2009).

In this chapter, the main focus is to exhibit different players inside the construction industry both from Ruukki and its customers. It introduces their working processes, the relationships and interactions between players. By displaying this information, it will clarify the value creation process and the interaction between different value creation processes.

5.2 Value Creation Process of Customers

5.2.1 The Six Roles in the Industry

Ruukki's customers in the building design and construction industry include building owners, building consultancy companies, design companies, material companies and construction companies. The amount of the personnel inside the industry is enormous, as is the number of different job positions. To establish the significance of the customer value-creation process, the roles of customers are classified by the customer's actual involvement with Ruukki in building project processes. These roles are: stakeholder, contractor, architect, engineer, vendor, and constructor. Figure 5-1 shows the relationship between these six roles in the industry.

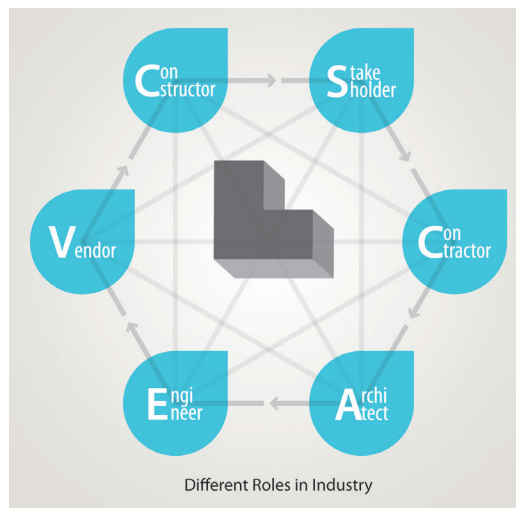


Figure 5-1 The six roles in building design and construction industry

Stakeholder

A stakeholder in a building project is usually the owner of the building, the initiator of the project, or an investor who participates in the project with the goal of gaining profit. Stakeholders have closer relationships with contractors and communicate with them regularly. They also interact directly with architects frequently during the project.

A stakeholder needs to understand the whole context of a building project: environments, regulations, materials, and architecture design. Moreover, they need to evaluate the project in relation to its profitability.

Contractor

A contractor is normally a person or a company that begins to become involved into a building project at the request of the stakeholder. Contractors assist stakeholders by going through different legislation offices to acquire the necessary permission and licenses for the project. They also help stakeholders select proper team members from architecture studios, engineering design companies, and construction companies. The contractors bridge communication between stakeholders and the team, by interpreting stakeholders' wishes to create project requirements. Furthermore, contractors communicate with architects and engineers about the building design, and they manage the project throughout the whole process.

Mostly, contractors act as the main project managers. They need comprehensive information about building design and construction materials. They must successfully communicate with other parties, coordinate the working processes, and monitor the schedule.

Architect

Architects are the collective design teams who are in charge of architecture, lighting, interior design and exterior design. They create a design based on the needs of stakeholders and contractors, and then collaborate with engineers to ensure the feasibility of the design and its detailed implementation.

Architects collaborate with engineers during the design phase, while communicating the design ideas to stakeholders and contractors.

They need to understand the vision of the stakeholders and the contractors, and synthesize this information into the architecture design. They also need to collaborate closely with engineers and have access to material information in order to ensure the feasibility of the design.

Building Engineer

Building engineers are a group of engineers who take care of electricity, air ventilation, thermal and sound insulation, and the structure of buildings. They create essential engineering designs for the building project and oversee design implementation during the construction phase. In order to find feasible solutions for certain design problems, they interact with architects, material vendors, and constructors.

Engineers possess knowledge about architecture design, construction materials and construction. They also need to create a seamless workflow to successfully communicate and coordinate with other parties involved in the project, and to resolve problems in the design. Engineers are the main target users of Ruukki's software.

Constructor

Construction companies are in charge of constructing buildings. They file material requests to material vendors based on detailed architecture plans and building engineering plans. They implement the architect's and building engineer's designs.

They must be able to exchange materials knowledge with vendors, and negotiate the building design with architects and engineers to coordinate construction work.

Vendor

Ruukki Construction Division plays the part of material vendor in the industry. Ruukki provides building components to construction companies, or other retailers associated with building construction. Ruukki also communicates with other parties before the construction work begins. Ruukki provides material-related technical information, assembly and building expertise, and the information of availability for distribution.

In general, material vendors provide existing products and customization services. They work closely with engineers, constructors, and architects. Material vendors actively seek opportunities to offer their business services, collaborate on projects, and make sales.

Figure 5-2 shows the needs of each major group involved in the construction industry. This information was acquired during the user study.

There are also additional sub-roles in the building industry, which include as government stakeholders and material retailers. However, the parties mentioned in this text are essential players in the building project process.

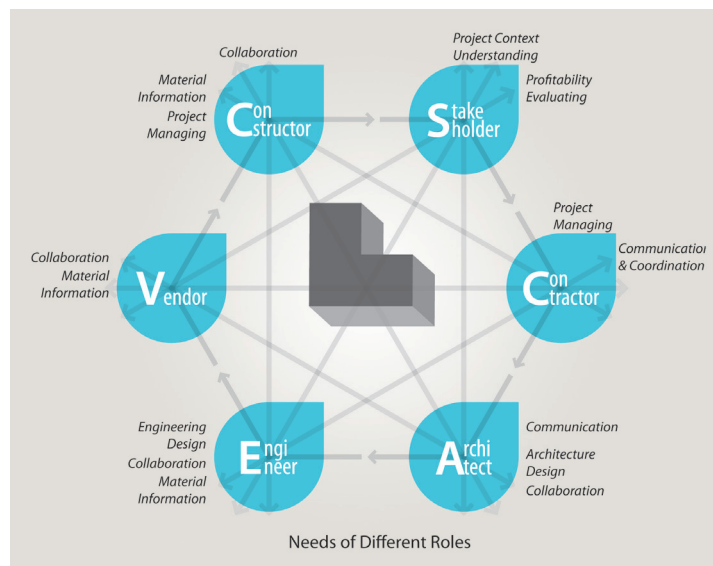


Figure 5-2 The needs of different roles in the industry

5.2.2 The Business Process from a Customer Perspective

The working processes of building projects differ quite a lot from each other. The nature of the processes comes from the intended use of the building as commercial or residential, and the vision of stakeholders. These factors influence the business process from a customer perspective. Based on

information gathered during the user study, an introduction to a typical building project follows. As figure 5-3 shoes, a real working situation is described by presenting different players in the industry, their involvement during each project phase, their interactions and their roles in the progress of the working process.

Planning Phase

Usually stakeholders create a building project in collaboration with contractors based on different agendas, and depending on the future use of the building: governmental facilities, commercial buildings, or residential blocks. When starting a building project, stakeholders take numerous issues into consideration: construction permissions, building licenses, the vision of architecture design and the project's feasibility. Stakeholders then recruit contractors to help plan comprehensive solutions for those concerns. Contractors bridge the gap of information from stakeholders to other groups involved. They assist in gathering necessary legal documents from the government, initiating discussions about building design with architects and engineers, and recruiting construction companies. They have experience interpreting stakeholders' needs and discuss design requirements with architects during the development of the architecture design. In the planning phase, other groups including engineers, material vendors, and construction companies offer their expertise in a relatively passive way.

Design Phase

Architects collaborate with engineers during the design phase in many different ways. They begin by defining design requirement with stakeholders and contractors, and then they create the architecture design. Major architecture designs proposed by architects are approved during a meeting with stakeholders and contractors. After the

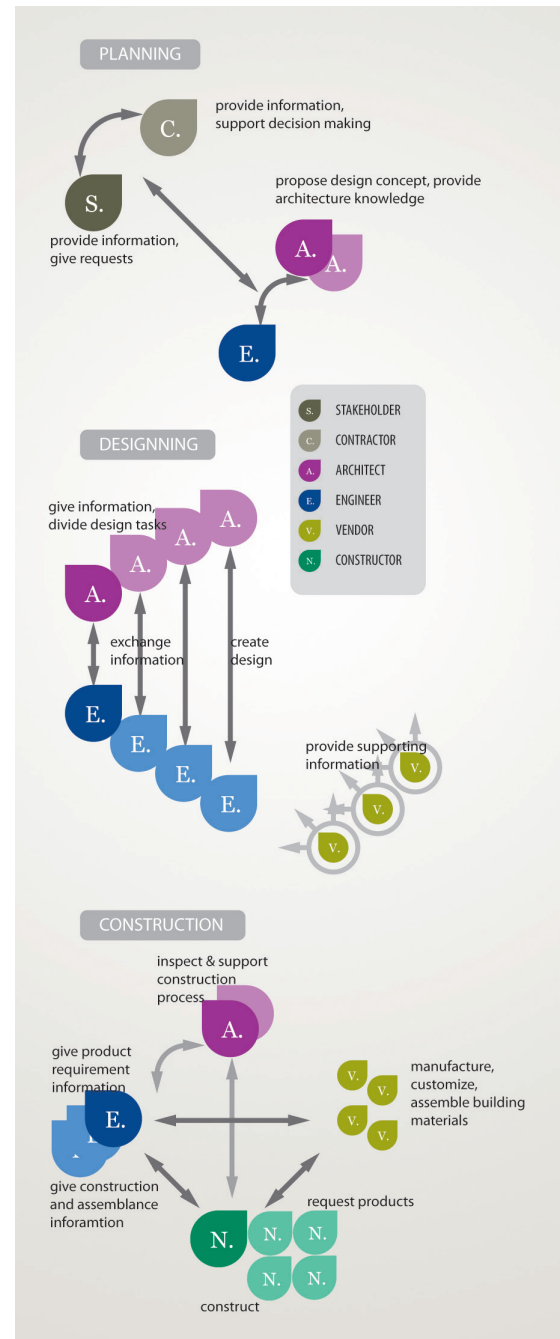


Figure 5-3 Roles and the interactions between three phases of a building project

design has been approved, architects work collaboratively with engineers on details of the design. During detail design work, the job is divided between design teams and areas of expertise. As part of the architecture design team, there are architects, lighting designers, interior designers, furniture designers etc. As part of the building engineering team, there are structural design experts (specializing in particular materials like wood, metal or concrete), electrical engineers, ventilation designers, and so on. These people work closely together and are assigned to work depending on the requirements of each job. Vendors like Ruukki usually become involved during this phase. They provide essential material information about technical specifications, dimensional data, structural analysis, and cost estimation. This information is important for architects and engineers to produce detailed constructing plans for the next phases of the project. Within Ruukki, project managers coordinate the work, and customer relationship managers deliver information to clients.

Construction Phase

After design phase, detailed plans of building construction are produced and delivered to vendors and construction companies. Vendors manufacture the construction components of buildings. They also customize certain components in order to match the design plans. Workers at the construction site will follow the detailed plan. Ruukki works actively with construction companies and material retailers to provide construction components. Other players will passively inspect the whole construction process and complete design changes depending on needs.

Throughout the different phases in a building project, there are different needs in terms of software applications as figure 5-4 shows:

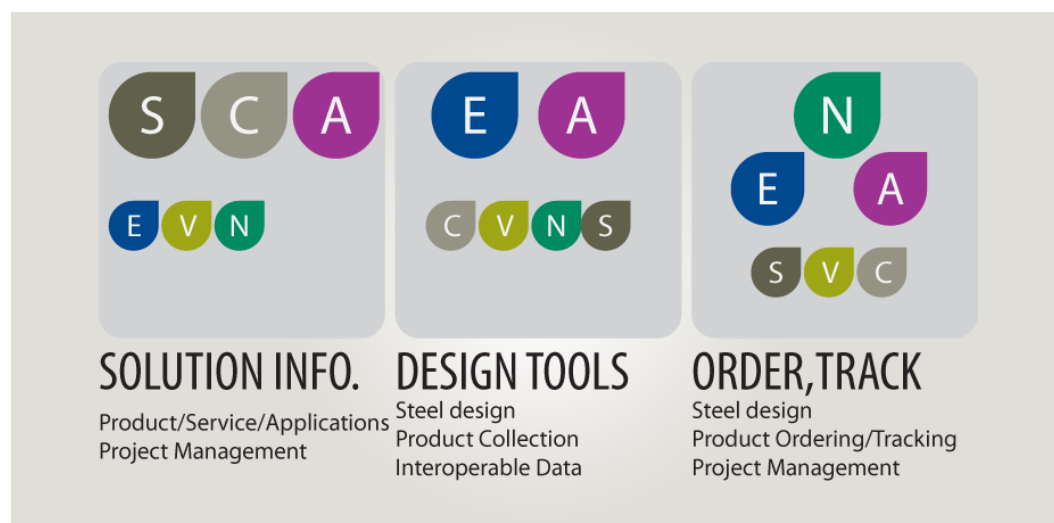


Figure 5-4 Ruukki's software offers a variety of functions and services to customers during the different phases of the construction process

- 1) In the planning phase, information about Ruukki services and products are publicized through different channels for publicity to customers.
- 2) In the design phase, engineers work extensively with steel-design applications and

digital object libraries, while architects make use of Ruukki services and product information.

- 3) In the construction phase, construction companies coordinate the construction progress with engineers and architects through different communication channels. This can include using Ruukki's software.

5.2.3 The Working Process of Individuals (Architects and Engineers)

To understand how different roles in the industry work, and to plan details for software development, two working process models of architects and engineers follow. Architects and Engineers have the closest relationships to Ruukki's software in their daily operations.

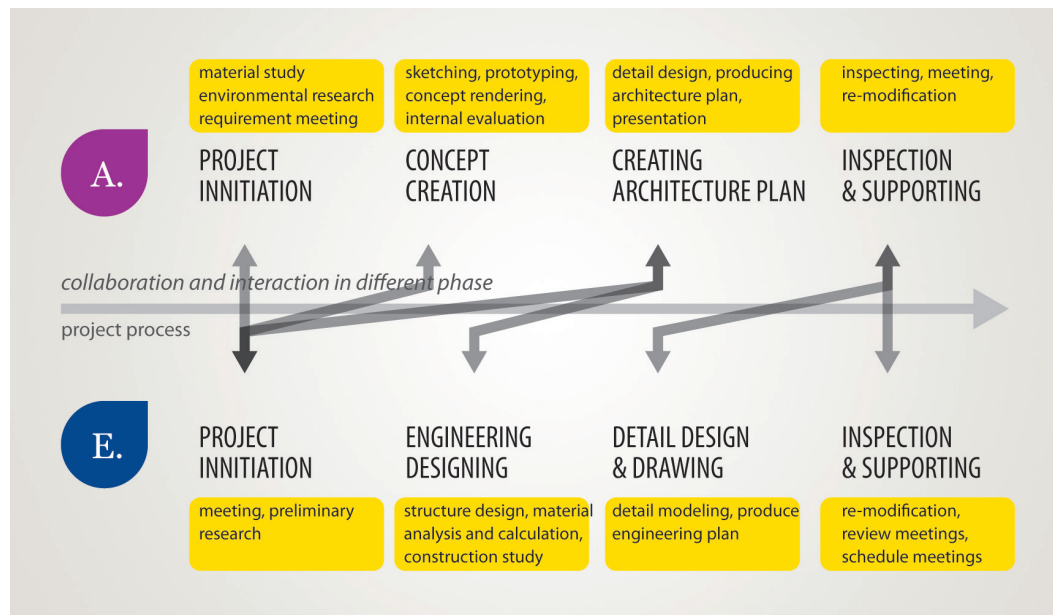


Figure 5-5 Working process of architects and engineers and connections between them

Architect

Project Initiation

In a building project, architects begin their work at an early point, as presented in the building project process. They acquire essential information about project needs and requirements by participating in initial meetings with stakeholders and contractors. They probe critical issues, study the physical location of the project, interpret stakeholders' visions for the project, propose possible directions and set expectations for stakeholders. Then, based on different proposals, they study possible construction materials including metal, wood, glass and concrete, and complete all necessary tasks in the initial phase of the project.

Concept Creation

After collecting the necessary background information for architecture design, architects begin creating concepts. They sketch; create volume models of their concepts; make

three-dimensional digital models; and create visual renderings. To receive stakeholder approval, architects present the renderings of architecture concepts or show the volume models they created. After several of iterative evaluations and re-designs, the architecture design is finalized.

Creating Architecture Plan

In larger building projects, this phase of the design and planning is divided into smaller parts. Specialists on architecture design, lighting design, furniture design, interior design, and detail works like facade design and internal wall design are assigned with specific tasks. While architects are creating the detailed architecture plan for the building, they work closely with engineers to ensure the feasibility of design. They create detailed three-dimensional models and architecture plans that are delivered to engineers for engineering design. The process is commonly iterative in this phase.

Inspection and Support

After finishing architecture and engineering plans, architects become inspectors during the construction works. They will inspect construction progress, and whether the construction plans are being followed. Architects also are responsible of design changes if difficulties are encountered during construction work.

Engineer

Project Initiation

In the initial phase of a building project, engineers are responsible for providing advice and recommendations about technology. They also conduct feasibility evaluation about building concepts according to the needs of the stakeholders, contractors, and architects. However, some detail solutions are not developed until much later in the engineering phase. Engineers also participate in meetings and do background studies for the project.

Engineering Design

After architects start the architecture design, engineers begin to participate. Structural engineers, electrical engineers, ventilation engineers, and others work closely with corresponding architects to evaluate the architecture design and proceed with the related engineering design. They use software applications like those supplied by Ruukki, and also professional programs like Tekla Structure.

Detail Design

This part of the project is work-intensive and very important. Engineers create detailed structural plans and provide necessary instruction for construction workers and vendors to proceed with the project. At the construction site, they need detail assembly plans and construction details. Vendors need detail plans about amounts of materials and customization plans for certain components. In some parts of the buildings, these plans can contain large amounts of data of hundreds or thousands of pages of blueprints. Engineering team divides the work to ease of the stress on individual engineers.

Together, engineering teams create designs, calculate loads, deflections, and evaluate other technical issues. Furthermore, they choose proper materials, analyze amounts of material needed and report their findings to the appropriate project manager. Steel-design software applications from Ruukki are generally used during this phase.

Inspection and Support

After delivering plans to related personnel, engineers become more passive, as constructors and vendors take control of the next construction phase. However, engineers remain responsible for any design changes and provide additional information when needed.

5.2.4 The Value Creation Process of Customers

By identifying roles, understanding working processes and interrelationships in building design and construction industry, a value-creation cycle can be created. The following image indicates the factors that improve business operations for customers.

Information Acquirement

What kind of products does Ruukki have? What do these products look like? How many materials are needed for the project? To answer these questions and acquire the information they need, clients seek a variety of different channels.

Building Design

Which of these product categories is the one for the building? What are the technical specifications? How much is needed? Based on project requirements, the appropriate products are studied and applied to the building design.

Building Plan

After the design has been created, clients need detailed plans of how many materials to order, and customization drawings and assembling drawings, in order to proceed with ordering material and building construction.

Design Communication

During the project process, meetings and communication occur constantly. Different personnel require different information to supervise the project and to make decisions, regarding design plans or ordering materials.

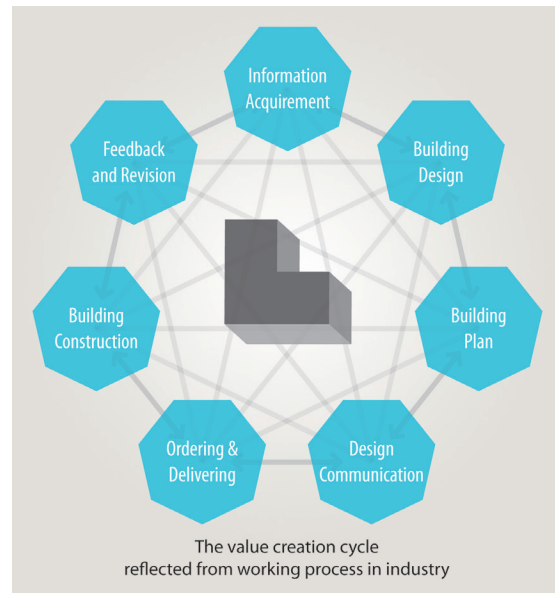


Figure 5-6 Business process for value creation cycle

Ordering and Delivering

Clients need to work with Ruukki sales staff or retail stores to proceed with purchasing plans. To keep on track with the construction plan, clients need to track the order and to know how long it will take for Ruukki to manufacture the components.

Building Construction

Each component is assembled in different ways at the construction site. Clients are provided with this information by Ruukki through customer relationship managers and project managers.

Feedback and Revision

From building design, component customization, ordering and tracking, and quality control at the construction site, clients have many questions. They need to be able to directly express their questions, concerns, and advice regarding the work.

Using these seven steps of working with Ruukki construction materials, there are corresponding factors that could improve working processes and bring extra value to customers.

- 1) Visibility and accessibility of Ruukki's product and service information
- 2) Accessibility of specific information and product information support
- 3) Supportive information and flexibility for product customization
- 4) Ability of reviewing and presenting building plans to different players
- 5) Ease of ordering, transaction, delivery and order tracking
- 6) Product knowledge for construction
- 7) Fast connection to customer relationship managers

5.3 Ruukki's Business Process

Ruukki's software assists Ruukki's customers with their daily business operations but it also provides a virtual space for business interactions. By understanding the business operations of Ruukki, it is able to create better software applications that reflect Ruukki's working process and help create more value for customers.

The roles defined in this thesis to discuss Ruukki's working process do not always correspond to actual job titles at Ruukki. The tiles used here are based on type of work and relationships to customers. By loosely aligning the cycle of Ruukki's working process, the roles are defined as: Planning, Development, Marketing, Finance, Sales, Manufacturing and Customer Relationship Management (CRM).

5.3.1 The Seven Roles at Ruukki and the Business Process

Planning

Planners are personnel including project or product managers and related stakeholders

at Ruukki who decide the general direction of specifications and the deployment of Ruukki's products, software, and services. They decide in general how and what construction components Ruukki includes in product portfolios, what applications must be created and they evaluate the operational benefits of it. These decisions define what kind of customers Ruukki reaches for business opportunities.

Planners need to understand different opinions from personnel at Ruukki and integrate information including requirements, opportunities, and regulations. Planners provide directions, strategies, and practical guidelines for Ruukki business operations.

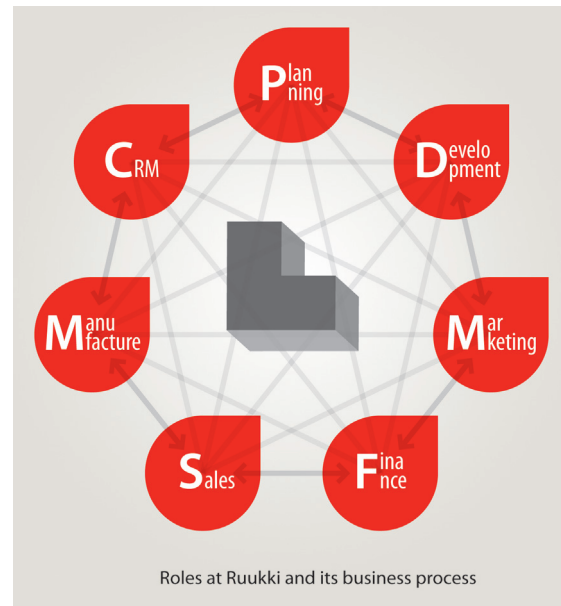


Figure 5-7 The seven roles inside Ruukki

Development

Product or project developers create Ruukki products, applications, and services. They have a close relationship with customers from different areas, and help create suitable products for them. Their responsibilities can be categorized roughly as new product creation, existing product modification, technology support and business cooperation.

Thus, most of the developers' knowledge that serves Ruukki is oriented towards product specifications, technological issues and construction information. They provide core information about Ruukki products and services.

Marketing

Marketers create the main forum for information exchange between Ruukki and customers. They assist in the creation of the website and web services that promote Ruukki's offerings.

They connect Ruukki and its customers and assist in the exchange of resources and information.

Finance/Transaction Manager

Transaction managers internally control Ruukki business operations. Although they are not directly related to any Ruukki products, their effectiveness and efficiency influences both business operations and profit generation.

Sales

Sales people deal with customers and manufacturers about issues regarding orders, transactions, and delivery. They have direct contact with customers especially personnel who are responsible for product orders.

They are experts in customers' needs regarding price and time management. They also receive customer feedback during business interactions.

Manufacturing

Manufacturers produce Ruukki products according to execution strategies and plans created by developers. As an example, construction materials could be built using a regular production plan; a customized component plan created Ruukki together with a customer; or a completely new production plan.

Manufacturers work closely with products that are delivered to customers. Effectively and efficiently utilizing resources is the important management task for manufacturers.

Customer Relationship Manager

Customer relationship managers deal with customers' feedback directly. They also handle the information exchange and educational training.

Through these activities, they bring customer feedback back to Ruukki, which helps the company better understand what customers want, customers' needs, and evaluate customer satisfaction. This information is valuable at each step in the Ruukki working process. They usually work with software developers on training users and solving users' problems.

5.3.2 Ruukki's Value Creation Process

Based on Ruukki's working process and on the input of different personnel, there are key factors can enhance the value creation process and create strong values for Ruukki's business.

- 1) Planning: Up to date, agile, flexible, and holistic strategy toward clients needs.
- 2) Development: Optimize product portfolio and create proper product bundle to match clients' needs.
- 3) Manufacturer: Manages resource effectively and efficiently and has dynamic flexibility for customization.
- 4) Marketing: Have systematic and effective portals for information exchange with clients.
- 5) Sales: Create easily accessible channels for ordering.
- 6) Finance: Create simple channel for transaction and delivery, and have a more efficient and error-proof procedure.
- 7) CRM: Provide channels and methods for exchanging internal information at Ruukki and receiving external information from clients.

Software applications aim to improve the working process, to make it more efficient and effective.

5.4 Software for the Value Co-Creation Process

The design strategy for Ruukki's software is to create software applications that will fit into the value creation process between Ruukki and its customers. The software aims to enable and enhance the value creation processes.

Also, Ruukki's software aims to contribute to the interactions within the value creation processes. The relationships between companies stem from the prominence of participatory mechanisms such as co-creation of value, and the dynamic nature of the interactions between Ruukki, Ruukki's partners and customers over time (Brohman et al. 2009). The creation and development of knowledge are reinforced through iterative and mutually reinforcing interaction processes (i.e., relationships) between actors involved in the value co-creation process (Vargo & Lusch 2004).

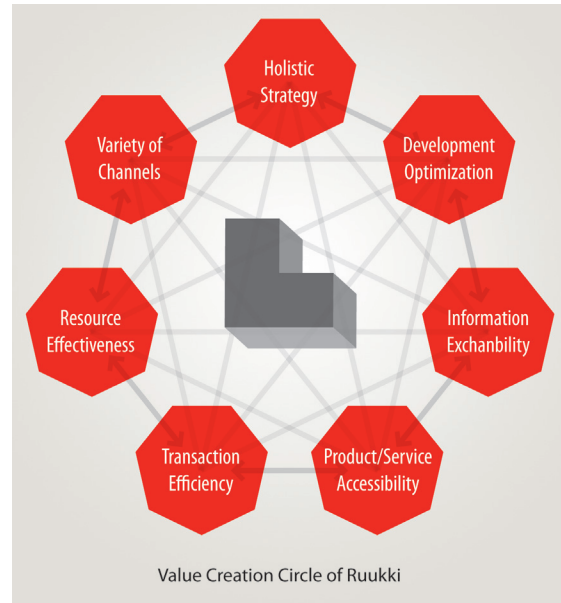


Figure 5-8 The value creation circle of Ruukki

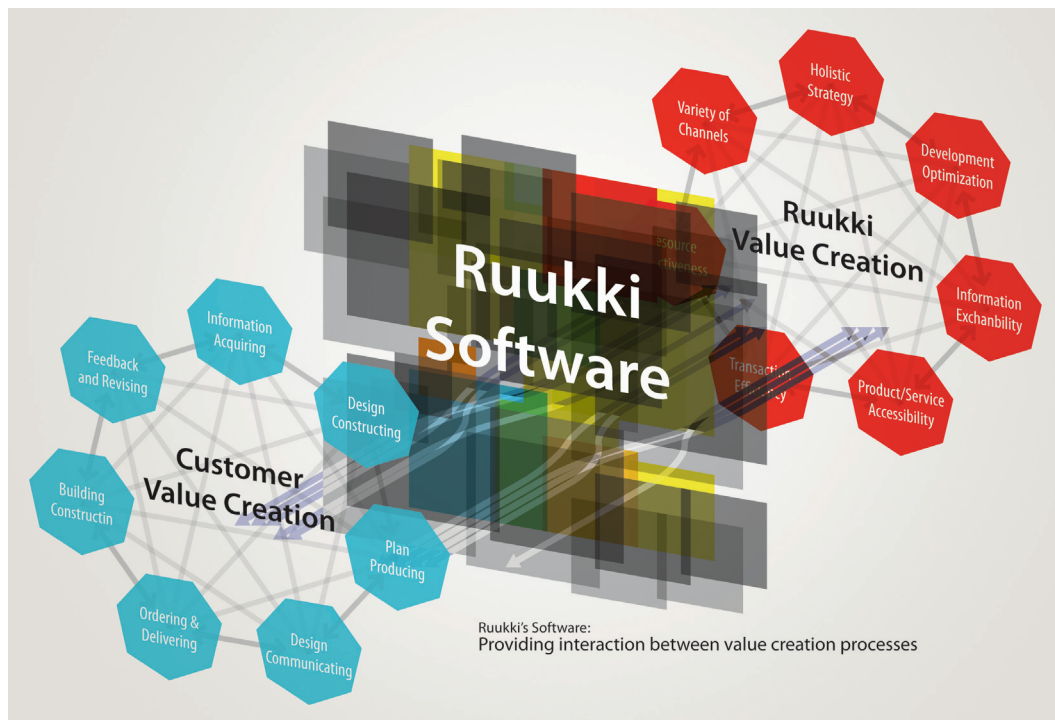


Figure 5-9 Ruukki's software is the ecological enabler of value co-creation system

Successful companies' focus of strategic analysis is the value creation system, within which different economic actors—suppliers, business partners, allies, customers—work together to co-produce value. The key strategic task is reconfiguration of roles and relationships among the constellation of actors in order to mobilize the value creation in new ways and by working with new players (Normann & Ramirez 1993). This strategy involves the co-creation of value through personal interactions that are meaningful and sensitive to each consumer (Prahalad & Ramaswamy 2004). Ruukki's software attempts to take advantage of these personal interactions, as figure 5-9 illustrates.

Thus, metaphorically speaking, the strategy for Ruukki's software is to offer a virtual space between Ruukki's business and customers' business to enable the value co-creation process. Ruukki aims to enhance the business process in both sides and enable interactions by providing interoperable data, information and a variety of functionalities for operations. This is achieved by designing with Ruukki products and through ordering and transactions.

By using and interacting with Ruukki' software, customers and Ruukki are able to streamline business processes, exchange knowledge, strengthen their relationships, and improve interactions. Ruukki's software contributes to the sale of Ruukki's products and services by the increasing involvement of customers. This mechanism will bring business success while establishing an ecological business system.

To conclude, there are three main points of this chapter:

- 1) The demonstration of the working processes in the construction industry that includes Ruukki and its customers.
- 2) By identifying roles, the working processes and relationships between roles, the value creation processes of Ruukki and its customers can be illustrated.
- 3) The design strategy of Ruukki software is to enable the value co-creation process and increase sustainability.

6 Technology for Implementation

Ruukki's Software enables an ecological business system of the value co-creation process. This can be provided for Ruukki and its customers by streamlining the business processes and by strengthening interactions between different players. To create software applications to following this strategy, it is necessary to re-configure the technological components of Ruukki's software to develop the underlying structure. As this thesis described in Background Study of Ruukki's Software, the challenges of developing software, besides fulfilling the strategy, is how to maintain consistency between different applications. Consistency of human interface, interaction and communication between applications must be achieved. Moreover, the requirement of resources must be optimized, since software is still largely constructed by employing some variant of the edit-compile-link cycle to generate an executable "binary image" from a source that is described using some form of procedural programming language (Turner et al. 2003).

As Internet technology grows overtime, e-business services are playing a more important part in business-to-business interactions (Burbeck 2000). The core concept behind e-business applications is based on a service-oriented model. This model is based on the study of Service Oriented Architecture and Web service. For Ruukki software, Internet technologies establish a substantial platform to create more accessible and rich interactions, and to help re-define roles and the relationship in business.

This chapter discusses the anatomy of Ruukki's software and the needs of different business parties. Following the outline, re-structuring of the system of software through implementation of design concepts from Service-Oriented Architecture and Web Service is discussed.

6.1 Anatomy of Ruukki's Software

6.1.1 Ruukki's Software in Detail

Ruukki's software	Functions for Users	Feature Description
Web Applications		
Rautaruukki Website	Information access portal	General company information, Ruukki offers information and portals for services
Software Toolbox Portal	Access to Ruukki software information, and the purchasing and downloading channel	Download and purchasing portal of Ruukki design applications
My Orders	Ordering, tracking, and access to product information	Online ordering and tracking service plus information sharing for customers of Ruukki Metal and Ruukki Construction
Eruukki	Ordering, tracking, and the access of product information	Online ordering and tracking service with order confirmation and material certificate archives for flat rolled and tubular products

Technology For Implementation

Ruukki's software	Functions for Users	Feature Description
RanNet	Ordering, tracking, calculation and access to product information	Online ordering and tracking service for roofing and façade products. Also it provides tools for material demand calculation
Eatra.ruukki	The access to Ruukki information and project collaboration	Multiple features for information sharing and project collaboration
Ruukki Home	The interactive access to product information and the customer service channel	Visual design tools for Roofing products
Native Applications		
Poimu	Product information, engineering design, calculation, analysis, and documentation	For load bearing sheet design
ComBeam	Product information, engineering design, calculation, analysis, and documentation	For composite beam design
ComSlab	Product information, engineering design, calculation, analysis, and documentation	For composite slab design
Winrami	Product information, engineering design, calculation, analysis, and documentation	For truss and frame analysis and design
Section	Product information, engineering design, calculation, analysis, and documentation	For cross section design
Rapalkki	Product information, engineering design, calculation, analysis, and documentation	For hoist girder design
ComCol	Product information, engineering design, calculation, analysis, and documentation	For composite column design
ColGraph	Product information, engineering design, calculation, analysis, and documentation	For column design
PurCalc	Product information, engineering design, calculation, analysis, and documentation	For light weight purlin design

Ruukki's software	Functions for Users	Feature Description
Traypan	Product information, engineering design, calculation, analysis, and documentation	For panel and liner tray design
Poimu Pre-Selection	Product information, calculation, and documentation	Load bearing sheet product pre-selected design tool. Intended for non-professional engineers to proceed with product purchasing
PurClac Pre-Selection	Product information, calculation, and documentation	Light weight purlin product pre-selected design tool. Intended for non-professional engineers to proceed with product purchasing
Expert Applications		
For ArchiCAD	Product information and tool for design assistance	The object library of Ruukki façade cladding and roofing products for ArchiCAD design application
For Tekla	Product information and tool for design assistance	Ruukki product profile for Tekla Structure application

Table 6-1 Detailed list of Ruukki's software in Used

Table 6-1 shows the overview of the current software applications and web services that Ruukki offers its customers. There are web-applications like “RanNet,” which provide online ordering services and product information about Ruukki's roofing and facade products. Native applications like Poimu, ComSlab, and WinRami provide customers with functions that assist with design, engineering, structure analysis, and component amount calculations. There are also object libraries for customers to import into other applications like ArchiCAD and Tekla Structure during architecture or engineering design.

These applications aim to provide specific services through their functions and features to fulfill customers' needs. These services are: product and service information browsing; project management; project collaboration; product ordering and tracking; architecture design; building engineering design; engineering calculations and analysis; construction planning; and customer relationship services. Each application incorporates either one or several services for designing, executing, communicating, presenting, and purchasing. Customers use particular software applications based on their job positions and their roles in the industry.

6.1.2 Applications Used by Different Roles in Industry

	Web Application	Native Application	Expert Application
Stakeholder	Information about Ruukki products and services, project management, project collaboration, and customer relationship services		Project management, project collaboration and documentation

	Web Application	Native Application	Expert Application
Contractor	Information of Ruukki offerings, project management, project collaboration, customer relationship services		Project management, project collaboration and documentation
Engineer	Information about Ruukki products	Engineering design, calculations and analysis	Engineering design, calculation and analysis
Architect	Information of Ruukki products	Architecture design, product browsing	Architecture design
Construction	Information of Ruukki products, ordering, tracking, customer relationship service	Calculation	Project management
Vendor	Information about Ruukki products, ordering, tracking and customer relationship services	Calculation	Project management

Table 6-2 Different roles in the construction industry use different Ruukki's software

Different customers require different services from Ruukki software:

- **Stakeholders:** Comparatively, most of the Ruukki applications and related services have a less direct relationship with the stakeholder of a building project. Stakeholders receive indirect benefits when other workers use Ruukki's software successfully. Ruukki's website and web services are the main information portal that stakeholders access when they need information or other resources. They also use project management and collaboration functions that other expert applications provide.
- **Contractor:** Contractors receive direct benefit from Ruukki's website and web-applications. By using Ruukki software, they communicate with sales, marketing, and customer service representatives from Ruukki. Contractors require specific information from Ruukki's website, and they use the project management, ordering and transaction features that web applications offer. Contractors have an improved working process as a result of the services of Ruukki's software.
- **Engineer:** Engineers use Ruukki applications to help them design and solve different engineering problems. Ruukki software must function well and be able to interchange data and documentation with other applications engineers use.
- **Architect:** Compared to engineers, architects must acquire information about Ruukki construction component for their designs. They use BIM applications and use Ruukki's object libraries. They also access the Ruukki website for information collecting and inspiration regarding choice of materials.
- **Construction:** Builders use Ruukki desktop applications when necessary to solve construction problems. They also use e-Services for ordering, tracking and project management.
- **Vendor:** Vendors contact Ruukki sales and marketing representatives for information. They use the Ruukki website and related e-services.

In general, stakeholders, contractors, and vendors (other retailers) frequently use Ruukki's website and web-applications, while engineers and architects more often use native applications and expert applications.

6.1.3 Services Offered by Applications

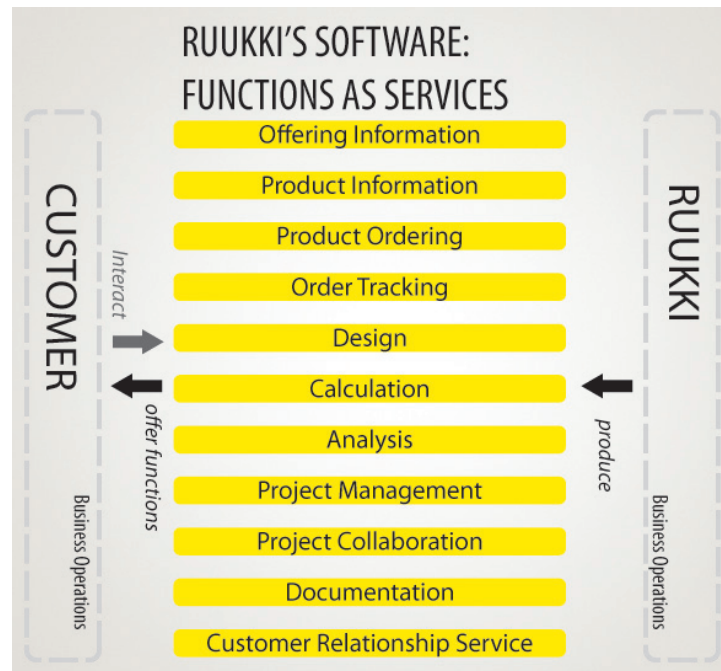


Figure 6-1 To view software functions as services

An outline of the software's functions as services illustrates the interactions between Ruukki, customers and Ruukki's software. As the previous chapter described, the role of Ruukki's software is very important in business-to-business relationships.

As figure 6-1 shows, Ruukki's business operations, provide a variety of services to

customers through Ruukki's software. These services include:

- Providing information: information is provided about Ruukki products, applications, and services.
- Product information: specification and technological knowledge of metal and construction products is offered in different formats.
- Design: functions allow users to create building designs using Ruukki products.
- Calculation: functions allow users to calculate the amounts of materials required.
- Analysis: functions allow users to analyze a design.
- Documentation: functions allow users to create a report based on their interactions with Ruukki's software. This includes use of the software for design, ordering of materials or calculations.
- Ordering: functions allow users to order Ruukki products, applications, and services.
- Tracking: functions allow users to track their orders.
- Project Management: functions allow users to manage tasks and resources, and schedule Ruukki services. Also, these functions can connect to other common project management applications.
- Project Collaboration: functions allow users to manage collaborative tasks, resources, personnel, and create schedules.

- Customer Relationship Management: functions provide multiple communication channels for users and Ruukki CRM managers.

These software services are offered to customers of Ruukki's products and services. By interacting and using these services, customers can proceed with their business operations. This is the basic structure of how Ruukki's software fits into this business system of value co-creation. Software functions must be seen as services because when they are used and combined in a dynamic way, they can be even more suitable to each customer's particular needs.

As described in Chapter Two, the current context of Ruukki's software in the industry has changed due to Internet technology and paradigms about the concept of software and services. Following is a discussion of two technological concepts, Web Service and Service-Oriented Architecture, which can help achieve the aforementioned benefits by seeing software as services.

Web services can decouple service interfaces from implementations and platform considerations, enable dynamic service binding, and increase deployment of cross-language, and cross-platform interoperability (Ferris & Farrell 2003). Web service and SOA can also reduce the complexity of software eco-systems by defining service interfaces in an unambiguous and transparent manner (Mike P. Papazoglou & Heuvel 2007).

6.2 Web Service

Web service is a loosely defined term. As a basic concept, it allows users to access and execute software programs via the Internet. Web Service software programs are modular applications that are self-contained as individual components with self-describing functions. Web services are published through the Internet and can be searched, invoked, and operated according to different requests in a platform-neutral manner.

The greatest benefit of Web Service is the ease that they can be combined and reused to create new web-service applications. This concept can be implemented in both technology and business situations; for example, in a business environment, this concept occurs as an automatic cooperation between enterprises. Any enterprise that requires a business interaction with another enterprise can automatically discover and select the appropriate web services based on their requirement (Fensel & Bussler 2002)

Three XML based technologies enable web services including Web Service Description Language (WSDL), Single Object Access Protocol (SOAP), and Universal Description Discovery and Integration (UDDI). These technologies are designed for different purposes. Web services are described formally in WSDL, they communicate with each other through SOAP, and can be registered and discovered through UDDI (Curbera et al. 2002).

6.2.1 Web Service Model

Figure 6-2 demonstrates the conceptual model of the effect of Web Service on Ruukki's software. This combination has several characteristics: (1) Ruukki's software becomes a collection of various service components as shown in figure 6-1. By implementing WSDL, these components offer formal and unified descriptions of how they should be used and

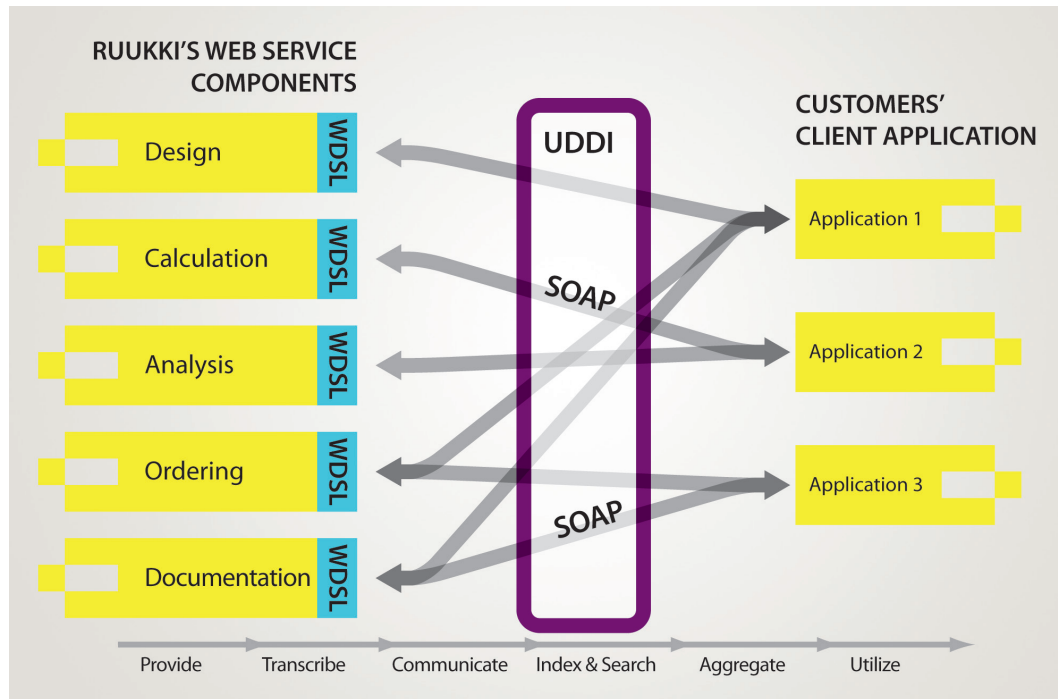


Figure 6-2 The effect of Web Service on Ruukki's software

what kind of data is needed during the interactions; (2) a client application can search and use service components registered on a UDDI interface to perform various business operations; (3) the interaction between client applications and service components happens through the communication of SOAP via the Internet.

6.3 Service-Oriented Architecture

Service-Oriented Architecture (SOA) is an emerging approach for software development. It is coupled with other Internet technologies to provide business process needs. This architecture maps Enterprise Information Systems (EIS) to the overall business flow by appropriately addressing the requirements of loosely coupled, standards-based, and protocol-independent distributed computing (Mike P. Papazoglou & Heuvel 2007).

Service-based applications are developed as independent sets of interacting services that offer well-defined interfaces to their potential users (M. P Papazoglou 2003). Service-based applications usually comprise a set of different software components, and enable users to invoke sequential operations in an event-driven and asynchronous style to proceed with their work and produce intentional results. For example, a structural design operation that uses Ruukki steel construction products might need to invoke different software components for design, analysis, information from a product information database, and customer support. Moreover, these operations eventually lead to documentation, ordering, and transactions that are processed by other personnel.

The basic structure of a SOA software system comprises three elements: they are service provider, service requester, and service broker.

Figure 6-3 illustrates the roles of this architecture and the interrelationships between

each service. The service provider enables various functions through application components. These components could be published for searching, discovering, and use through the service broker. Through a registering and categorizing mechanism, the service broker provides searching and discovery functions that service requesters can use. Service requesters are the client applications that provide necessary functions and conduct specific tasks.

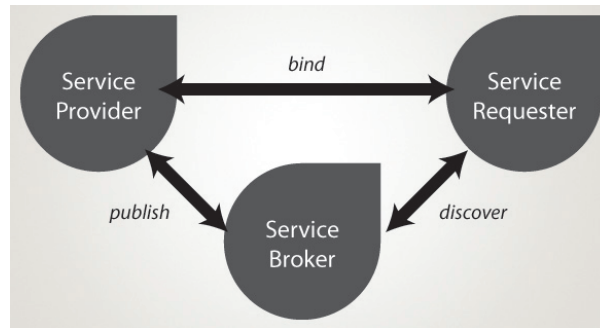


Figure 6-3 The model for Service-Oriented Architecture

6.4 The Conceptual Model of Ruukki's Software

The value proposition of Ruukki software is based on its role of creating interaction between business processes. By deploying SOA in the abstract level of software development, developers can decrease complexity of software distribution, integration, transaction and security management. For interactions between enterprises, SOA is focused on creating a design style, technology, and process framework that will allow enterprises to develop, interconnect, and maintain enterprise applications and services efficiently and cost-effectively (Mike P. Papazoglou & Heuvel 2007). In the practical level of software development, deploying web service gives Ruukki software the greatest potential to create a better-integrated system. Web services have become the preferred implementation technology for realizing the SOA promise of maximum service sharing, reuse, and interoperability (Kreger 2003).

In comparison to the conceptual model that will be introduced later, the current model of Ruukki's software is shown in figure 6-4. Ruukki develops different software applications and distributes them through two main channels: the Software Distribution Portal for downloading, and the web application webpage for use through an Internet browser. By deploying SOA and Web Service into Ruukki software, a new model can be created that

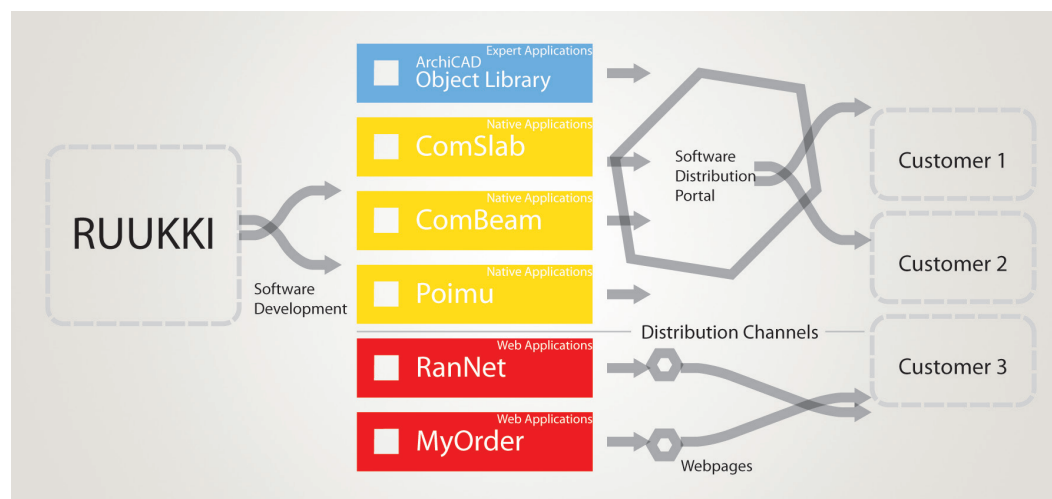


Figure 6-4 Current model of Ruukki's software

is integrated with Internet technology and enables seamless business interactions between Ruukki and its customers. The infrastructure of this new software is illustrated in figure 6-5.

At the bottom of the image, the internal working process of Ruukki is illustrated through several business applications: Enterprise Resource Planning (ERP) applications, Customer Relationship Management (CRM) applications, Inventory Management applications, and an aggregate database. These applications will produce a vast amount of interoperable data, and different service components related to Ruukki's products and services.

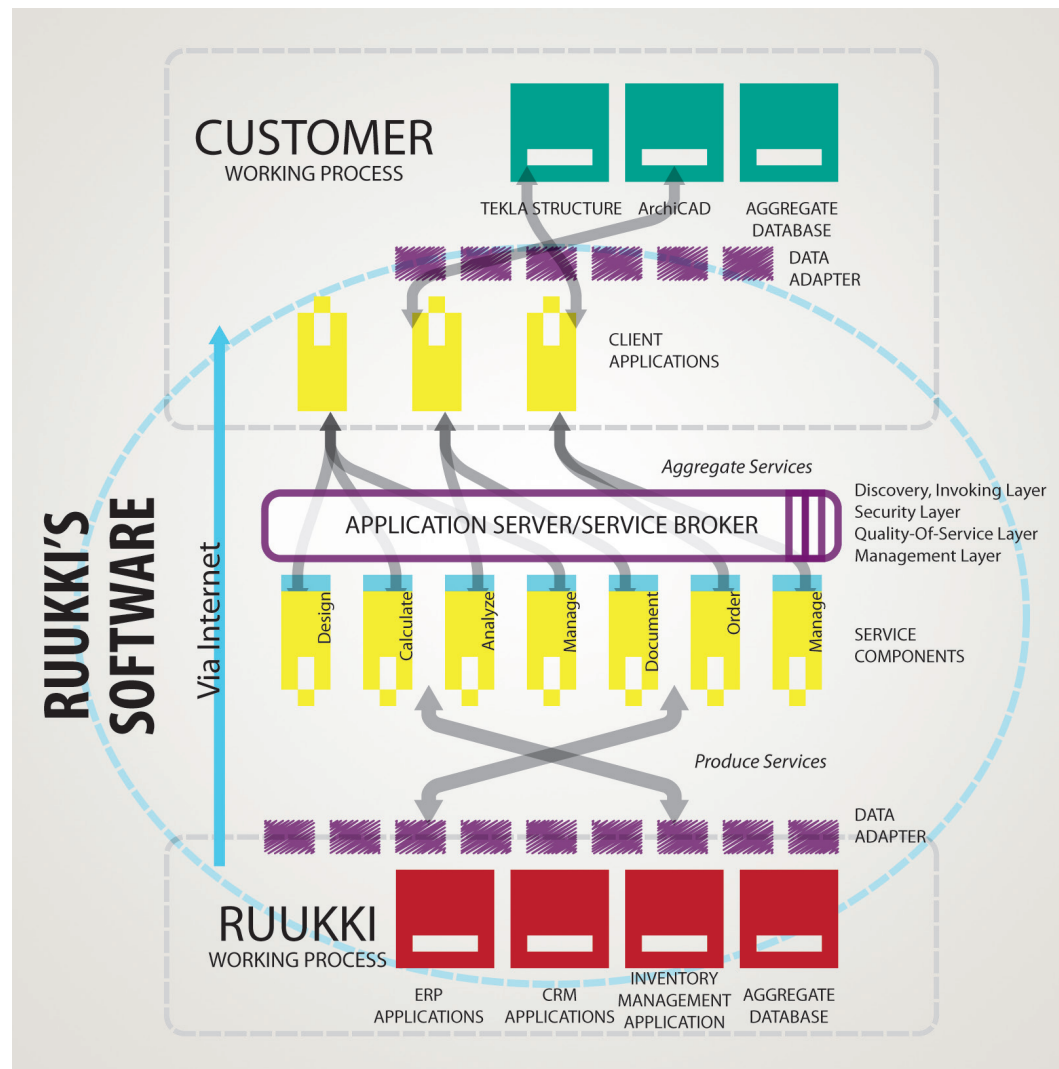


Figure 6-5 The technology installation for Ruukki's software under the implementation of SOA and Web Service

The service components of Ruukki's software provide various functions that can be flexibly combined and used for client applications. The actions for customers, from the client applications side, enables the search and discovery of service components that will be realized on the layer of application server, i.e. the service broker mentioned in SOA. In

this server, management layers will be built in as routine services to ensure that reliability; security and Quality of Service are provided.

The client applications can be developed platform-free, while accessibility to different service components is maintained via the Internet. The operation of these applications and the customers' enterprise applications can be bridged by interoperable data.

From top to bottom, this architecture is also capable of quickly adopting customers' inputs to service components in order to revise services dynamically and efficiently.

In conclusion, Ruukki software system will have four features, as listed below:

- 1) SOA infrastructure will provide scalability that will enable Ruukki to develop new applications by combing and orchestrating different service components. The way services are described, organized, specified by potential users, and discovered amidst the clutter of the Internet will determine the success of B2B services (Burbeck 2000).
- 2) Web Service is the key technology that will be used to realize the potentials of SOA in the development of Ruukki software.
- 3) Data interoperability dictates that the value of the software is proportional to the scale and the dynamism of the data it helps to manage (OReilly 2005). To ensure the information flow between Ruukki business system and its customers' business systems, interoperable data is important in different execution phases.
- 4) Coherent semantic on the design of interface is important issue for the outer layer of Ruukki's software. To provide consistent user experience to customers when they operate Ruukki's software, semantics and the interface design of applications should have unified logics that match users' behavioral patterns and working processes.

7 The Interaction Design of Ruukki's Software

Software applications are built to help business entities to streamline their working processes. The value of Ruukki's software is its ability to transform intangible information and knowledge into interoperable, computational data, and provide a digital platform for both customers and Ruukki to use the data. The outer layer of an application, is the interface that enables human interaction. The interface determines how easily users can access to the value.

“Interaction design is process (*1).” It is composed of human-centered-development activities. Good interaction design requires a focus on quality development processes rather than simply results (Nielsen 1993). In this chapter, the basic structure of human activities, how people perform actions, will be introduced. Then software's potential to fulfill and satisfy users' needs by understanding their goals, tasks, and actions will be explored. Furthermore, an overview of methods for interaction development that include a user study, the creation of a persona, and task analysis with an interface design example, will be provided. These methods are required in the design of software interaction.

*1: The original sentence is “usability engineering is process,” from Usability Engineering by Jakob Nielsen (Nielsen 1993).

7.1 Design for Interaction

The creation of good software interaction relies on a good understanding of users, their goals, their working processes, and their personal and business contexts. The three essential topics related to understanding users are human activities, goal-task-action, and models.

7.1.1 Understanding User Activities

In “Design of Everyday Things,” Donald Norman (Norman 2002) proposed a seven-stage approximate model of human activities. It explains how our minds are constructed and provides useful insights for interaction designers.

These seven stages are:

- 1) Forming the goal
- 2) Forming the intention
- 3) Specifying the actions
- 4) Executing the actions
- 5) Perceiving the state of the world



Figure 7-1 Donald Norman's seven stages of human activities

- 6) Interpreting the state of the world
- 7) Evaluating the outcome

As figure 7-1 shows, the seven stages can be separated into two parts. First part is “execution”. In daily activities, we usually start with a vague goal, or something that we want to do. Next, we form intentions that will help us achieve this goal. The tasks help us to specify the concrete actions that we need to take.

After the execution, the second part of our activities is the evaluation. Evaluation means that we evaluate whether the taken actions helped us achieve our goals. First, we have to perceive the current state of the world, which is the general term for the consequence of the modified objects or events. We interpret whether a change has occurred by comparing the current state of the world with the state of the world before we took the actions. Finally, we evaluate if the change in the current state of the world has helped us achieve the goal.

Using this model to observe and study our users should give us significant insights of how to create a better interface. Norman further explained his four principles of good design:

- **Visibility:** users should be able to find the visual clues about the state of the device or the interface and the alternatives for action.
- **A good conceptual model:** designers should provide a good conceptual model for users, i.e., a consistent and coherent interface both for operations and for presenting results.
- **Good mappings:** users should be able to easily understand the relationship between actions and consequences that indicate the original state of the interface and the changes that occurred.
- **Feedback:** users should be informed fully and continuously throughout each step of actions and results.

7.1.2 Goal, Task, and Action

To design a better application, it is necessary to understand the users' context and their working process. From the seven-stage model, three activities in the working process can be established: goal, task and action.

A goal is the expectation of an end condition; whereas, activities and tasks are intermediate steps that help the user reach a goal or a set of goals (Cooper et al. 2007). A goal is the motivation that drives users to perform certain activities. For Ruukki's customers, this goal is usually driven by aspirations and the expectations of the business, organization, and the individuals. “Task” is a term used by Alan Cooper in his book, “About Face 3: The Essentials of Interaction Design.” A task is an “intention,” referring to Donald Norman's human activity model. Task defines what actions should be taken to achieve the goal.

The conventional development process for the interaction of software is based on the tasks users need to perform for corresponding functions to result. However, this can lead to an overwhelming number of functions within an application. Another approach is to focus on users' goals. This is an approach that helps developers interpret the needs of the users more comprehensively, and to evaluate which functions need to be put into the application.

By understanding users' goals, tasks, and actions, applications can be created that match users' working processes in a rational and rigorous way, and lead to a high-level of user satisfaction.

7.1.3 Implementation Model, Representational Model, and Mental Model

In order to transform understandings of users into the development of software, it is important to understand the difference between the implementation model, representation model, and mental model. This also responds to the aforementioned principle of good design, which is a good conceptual model. The word of “model” is used here to explain the hidden mechanism of how developers intend to create the applications, by deciding how the application will look and function, and how users will perceive and use the application.

An implementation model is a mapping of the logic of how interface designers and software programmers intend to create software applications. After arranging and organizing the information listed in the project requirements, they combine elements including functions, images, and data to build applications. The development process has a strong effect on the end results. For instance, in the past, to search, users were often required users to input “OR” and “AND” between keywords to specify what they wanted to search. This function is the direct reflection of Boolean Logic, which developers used in the program code. Such requirements make the use of programs more difficult.

A mental model shows what users intend to do, and their understanding of how to do it. For example, to search meal recipes from Google's website as figure 7-2 shows, users will likely input their search phrase into the blank box on the screen and then press the button labeled “Google Search”. This mental model is created based on users past experience, knowledge and perception of the situation (the interface).

Representation Model is the actual presentation of the interface and the interaction of software. It is the model that exists between the implementation model and the mental model. A good design creates a better representation model that enables users to more easily follow their mental model and understanding of how to operate the application and achieve their goals. The human mind tends to create a cognitively simplified model based on the perceived situation. This helps

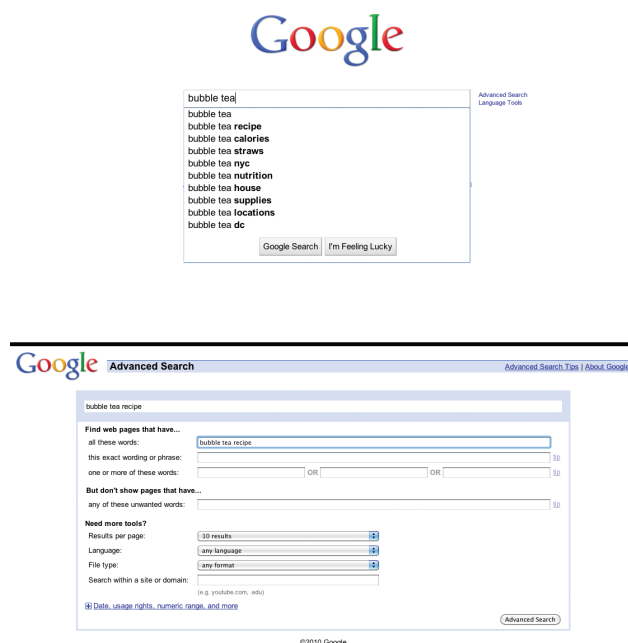


Figure 7-2 Take Google Search as an example, in most of the situation users are not required to specify their keywords to find out their desired results although they can still find such Boolean Logic function in advanced search page when it is needed.

to process the information more easily and to perform actions more quickly. From a programmers' perspective, using "OR" and "AND" in a search, is an efficient and precise way to receive the best results. However, this is not a user-friendly approach and can become difficult and frustrating for users.

An awareness of the difference of implementation model, representation model, and mental model enables the creation of a better interaction interface for software.

7.1.4 Interaction Design Principles

To conclude the discussion of users, there are two corresponding design principles that can be applied to the interaction design of Ruukki's software:

Process-oriented and Goal-directed Principles

In the conventional feature-directed development process, software developers tend to focus on creating a feature list in their preliminary work that can serve as a development guide for future stages of the project. This process seeks to fulfill users' needs in predefined situations, that would be likely to occur while they are performing a task. However, it is difficult to anticipate the dynamic nature of the working process and the workflow in multi-disciplinary working environment. Furthermore, feature-directed development might add unnecessary complexity to the software integration process.

By understanding users, it is evident that the development of interaction design for Ruukki's software requires an understanding of users' personal goals, business goals, context of their work, the business context, and an understanding of the working process.

Moreover, the software should also focus on the differences of working processes between different users. This process-oriented and goal-directed principle will help to create a more satisfying software application that will provide a better user experience.

Visual Clue and Rich Feedback

The operations of software applications should match to users working processes and their mental models. The interface and the interaction should provide informative visual clues for users to understand what they can do to complete their tasks in an effortless way. In addition, the interface should constantly give rich feedbacks to help users evaluate if their desired goals have been achieved.

7.2 Tools for Creating Interaction Design

Following is a collection of interaction design methods for Ruukki's software. It includes instructions of how to collect user data, how to interpret the data, and how to represent it in design work. An interface concept design is also provided to give a concrete example of the application of these methods.

7.2.1 Collecting User Data

There are numerous user study methods developed in the marketing and design fields that are commonly used in interaction design and software development. For example, user

study methods can include market segment analysis, focus groups or contextual inquiries. Each method uses a different approach to collect user data and generate for future use. The methods can be grouped as qualitative or quantitative methods.

In *Contextual Design*, a book by Hugh Beyer and Karen Holtzblatt, it is argued that “quantitative techniques using predefined questions can identify the market and show designers where it is interesting to explore. Understanding the work of the market requires a qualitative technique that explores the customers’ work practice and makes new discoveries about how people work and what they need (Beyer & Holtzblatt 1998).”

Alan Cooper also proposed that qualitative methods be used. Qualitative methods can help developers to understand:

- 1) Behaviors, attitudes and aptitudes of potential product users
- 2) Technical, business and environmental contexts –the domain of the products
- 3) Vocabulary and other social aspects of the domain in question
- 4) How existing products are used

Following is the introduction of one of such method, contextual inquiry.

Contextual Inquiry

“Contextual techniques are designed for gathering data in the field, where users are working or living (Beyer & Holtzblatt 1998).” These techniques can help software developers make sense of users’ work structure, unarticulated needs, and details of “hidden” issues, which may not be evident because they have become habitual. With this evaluation, developers can identify users’ goals and working processes, then indicate how they can be best served.

The most common and sufficient form of contextual inquiry is contextual interview. It contains four main principles that can be followed during an interview session:

1) Context:

An interview should be held in the actual work setting. Observe user at work to acquire concrete yet specific data. Keep users from abstracting their experience with applications; instead, requiring them to always refer to real artifacts and events.

2) Partnership:

The relationship between the developer and the user in an interview situation must be equal and collaborative. The interview should not fall into a mechanical process of questions and answers. Developers should pose questions from an apprentice’s perspective to help interviewees shape the work structure and form the understanding.

3) Interpretation:

Be careful interpreting the findings after-the-fact. Discussing interpretation during the interview provides users with opportunities to help fine-tune these interpretations.

4) Focus:

Set up a focus of the questions during interview and expend it when encounter what you

don't know, surprises and contradictions. Challenge pre-formed assumptions, rather than seeking to confirm them.

Alan Cooper has also elaborates his thoughts on how to acquire qualitative data during an interview:

- 1) Hold interviews at where the interaction happens.
- 2) Avoid a fixed set of questions.
- 3) Focus on goals first, tasks second.
- 4) Avoid making the user a designer.
- 5) Avoid discussions of technology.
- 6) Encourage storytelling.
- 7) Ask for a show and tell.
- 8) Avoid leading questions.

User data represents rich contextual information that emerged and is generated during of the use of applications. With this information, designers and developers can proceed with development with a proper and holistic understanding of their customers.

Creating a proper representation, a model, from user data is the next important step of interaction design. In the following section, two methods that can be used during development are presented, persona and task analysis. They help to represent users' goals, tasks.

7.2.2 Using a Persona: Interpret the User's Goals

"Personas are composite archetypes based on behavioral data gathered from the many actual users encountered in ethnographic interview. By using personas, it is able to develop an understanding of users' goals with specific contexts. It is a critical tool for using user research to inform and justify our designs (Cooper et al. 2007)."

What makes one user different from another are their own discrete personal goals, preferred working processes, and ways of perceiving and evaluating accomplishments. Identifying this information is the first step to constructing personas.

Here are four steps summarized from Alan Cooper:

- 1) Identify behavioral variables and patterns
- 2) Synthesize characteristics and goals
- 3) Check for redundancy and completeness
- 4) Expand description of personal attributes and behaviors

To create a solid, convincing, and useful persona, goals should be placed as a gravitational point of the content, and then used to expand persona based on the goals.

There are also other similar methods that are used to interpret user data; for example, market segment analysis and user profile. The key between these approaches and the creation of

a persona, is that persona is a representation of user behaviors, goals, and interactions with an application, while market segment and user profile provide information about demographics, product distribution channels, and purchasing behaviors. Persona is more applicable to the interaction design since it tells more specifically how software applications should perform and interact with users. Other methods help create complimentary models that indicate market opportunities and facilitate the selection of users for interviewing.

7.2.3 Process Analysis: Interpreting the Tasks

A process analysis assists with the interpretation of users' goals and the tasks they will perform with Ruukki's software. While goals usually can remain general, process analysis should be conducted in a concrete and specific manner. A typical outcome is a list of the tasks users want to accomplish that includes the information they need to acquire; the steps that need to be performed; various outcomes and reports that need to be produced; the criteria for determining the acceptability of results; and the communication users have to proceed (Nielsen 1993). The results can be presented in a list, hierarchical map, flow chart or matrix map, depending on the data acquired during the user study.

During a contextual inquiry, interviewers should ask interviewees to provide examples of how they conduct their tasks with applications, what functions they use, and what outcome they produce. It is suggested that interviewees provide a demonstration to the interviewer of how they execute tasks in the application. During the demonstration, the interviewer could ask: "why did you do that?," "how do you do it?," "have you ever made a mistake at this point?," or "how do you correct this error?." These questions should be posed frequently, as they invite users to talk more about their work.

To conclude, the knowledge users must acquire to perform their works; the functions they use while working with applications; the steps they take in their work; the outcomes; and the people they work with all provide valuable information to a researcher.

7.3 Example of an Interaction Design Process

7.3.1 Objectives of Presenting Case Study

The interaction design concept for the Knauf panel product search application provides an example of how the aforementioned design principles can be translated into a concrete implementation guide for use.

Knauf is a simple application in terms of feature, function, and interaction. This search application provides limited but necessary functions for engineers to search for panel components based on their required specifications. After engineers have made the selection, the application provides technical information that is necessary in the next stages of the engineers' work.

This example presents a simple and typical development process of interaction design, following process-oriented and goal-driven principles.

Project Brief

The Knauf product search application was developed to help designers and builders choose the correct panel products, and understand the best way to use them.

Below is a list of application requirement that designers received from the clients at the initial stages of a project. This list presents the basic requirements of a searching function and the desired outcomes of the application.

User select criteria	Possible Need Outcome
Height	Design of panel (material layers)
Fire	Specification (based on criteria)
Accoustic	Mounting Instructions (screws, joints)
Width	Prices Index
Load	Specification (in data sheet format)
Material	

Table 7-1 Project Requirement of Knauf Product Searching application

7.3.2 Project Process

User Study

The first task of the user study was selecting appropriate candidates for an interview. In this project, based on the initial requirement and the developing schedule, structural engineers were chosen as the target groups. This selection was also based on the fact that structural engineers are the group that demands the most material specifications of panel products.

Interviews were conducted in the engineers' work place and followed the contextual inquiry method. Each interview took approximately one and one half hours.

Following is the list of prepared questions:

- 1) The first question is about the people you work with. Let's start from inside the company. Who are they? What are their responsibilities?
- 2) Second, let's talk about clients or customers. The same questions as above.
- 3) Let's talk about how you work with them. How do you communicate with each other? What tools or methods you use in communication.
- 4) How do you usually search for products?
- 5) What kind of decisions do you make in your job? How often do you make these decisions? Are they related to another employee that we have talked about before?
- 6) Tell me more about what kind of applications you are using in your work.
- 7) How did you learn to use these applications? How did it go? Tell me more about your computer skills.

These were the basic questions used during the interview. There were also other impromptu questions posed during conversation with the interviewee. The interview was

recorded and transcribed into documents.

Personas

The persona is constructed based on the interesting points from the transcripts, the working process, people they work with, and the interrelationships. It represented the archetypical user by presenting two categories of work-related goals and different aspects of the working process as table 7-2 shows.

One user has mentioned during interview that he thinks a typical engineer is characterized of “problem solving.” Even though it might not present all the engineers, this characteristic seems to be the most intriguing and useful during the design phase.


Structural Engineer		
	Project Requirement and Goals	
	I want to know which product I can use for structural engineering.	Goal related
	Architects forward their design to me for structural design.	Task related
	I have been asked to create a structural design.	Task related
	I want to know which KNAUF products fit “my requirement“	Goal related
	Characteristics of Work	
	Very familiar with “problem solving”.	Goal related
	A good working routine (process) is an effective problem solver.	Task related
	More specifically, a consistent and easy-to-understand process or workflow is helpful.	Task related

Table 7-2 Persona of Structural Engineer

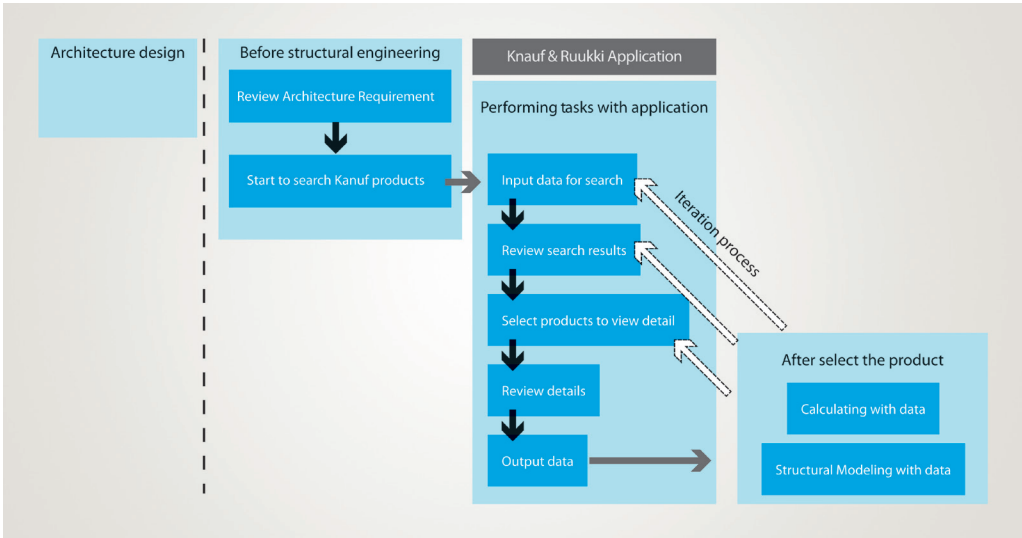


Figure 7-3 Task analysis of how to use the application

Task Analysis

A task analysis was conducted and based on the user study. It is presented in a flow chart as a list of actions, as figure 7-3 depicts. It clarifies the process of how structural engineers choose panel products.

The core findings relating to interaction design from task analysis, was how to simplify the iteration process. The task of searching for products is less difficult than many other daily activities of structural engineers. As a result, increasing the speed of the searching process, and simplifying the steps for iteration was the primary concern for interaction design.

Design Requirements

The design requirements combine the preliminary application requirements and the findings from the user study. The results are presented below:

Functions	Input for search, review search results, review details, output results
Criteria for search	Height, Fire, Acoustic, Width, Load, Material
Outcome	Design of panel (material layers), Specification (based on criteria), Mounting Instructions (screws, joints), Prices Index, Specification (in data sheet format)
Consideration of Interaction	Visual hints integrated into working process, clear and linear use of the applicaiton in a way that matches a typical working process, speed of performing search, review, select, a simple step for iteration

Table 7-3 Design requirement of Knauf panel search application

This list gave a clear picture of important factors when designing the interaction. It was presented as the design requirements that needed to be considered during the interaction design process. It was also used as materials for designers to communicate with other stakeholders. The interface design concept can be based on these design requirements, and the persona and task analysis results.

Concept Example

Figure 7-4 to 7-7 present the interface concept design. Figure 7-4 shows an overview of the design concept. As mentioned before, the concept is focusing on interaction design and the behavior of software, and not just the visual elements. The interface of the application consists of three main panels: search, search result, and detail information. Figure 7-5 shows the functions of each button on the interface. Figure 7-6 presents the workflow of a user operating this application. Figure 7-7 displays the end results of using this application.

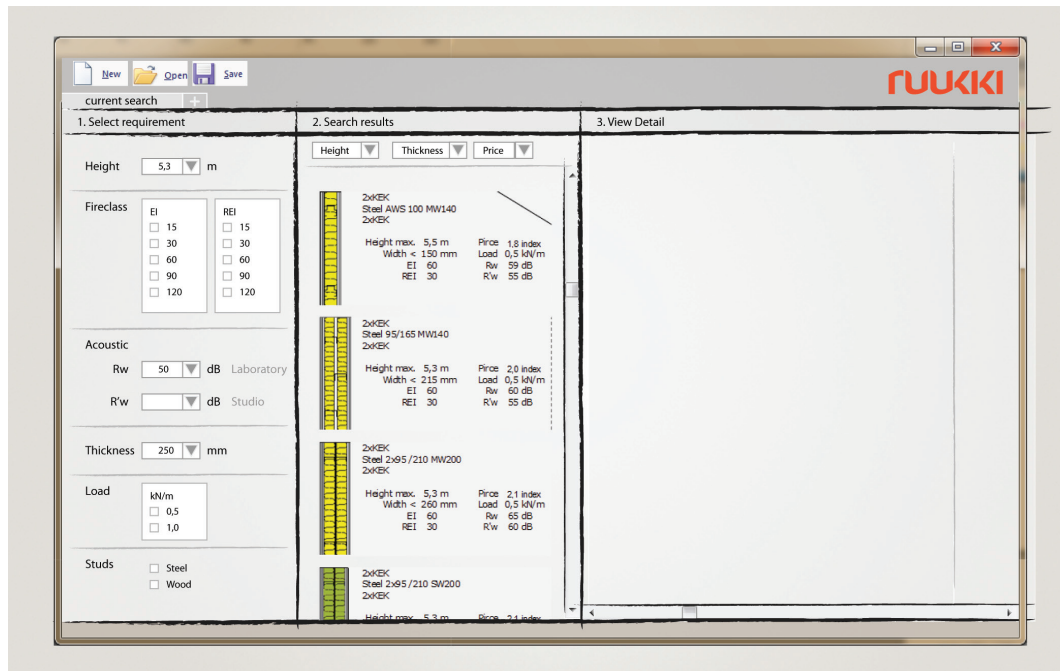


Figure 7-4 Overview of the concept

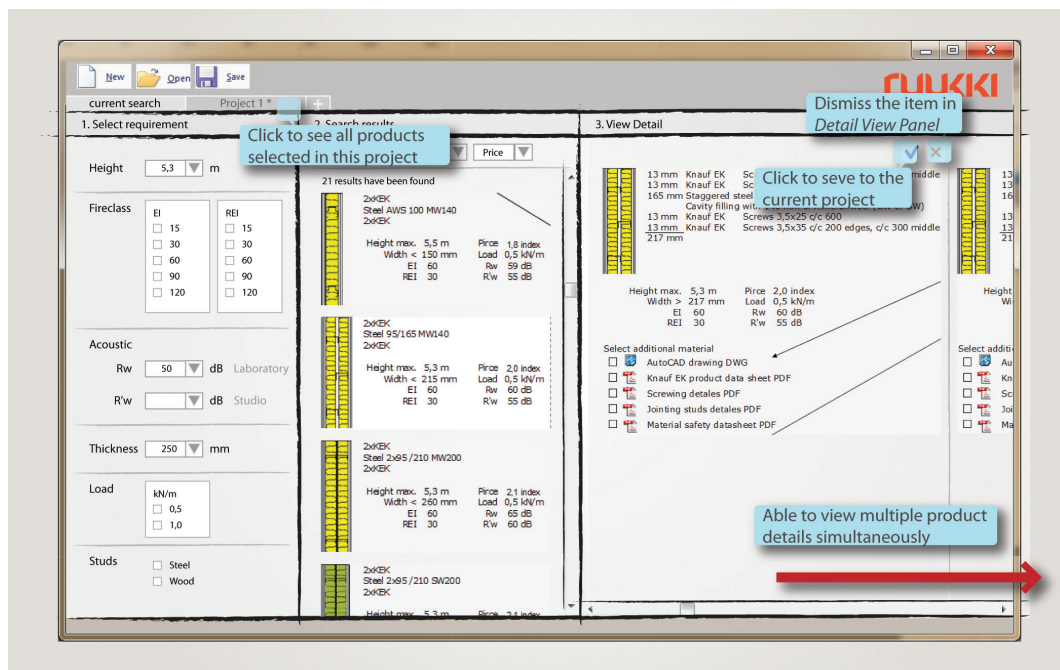


Figure 7-5 Detail explanation of visual elements and interaction

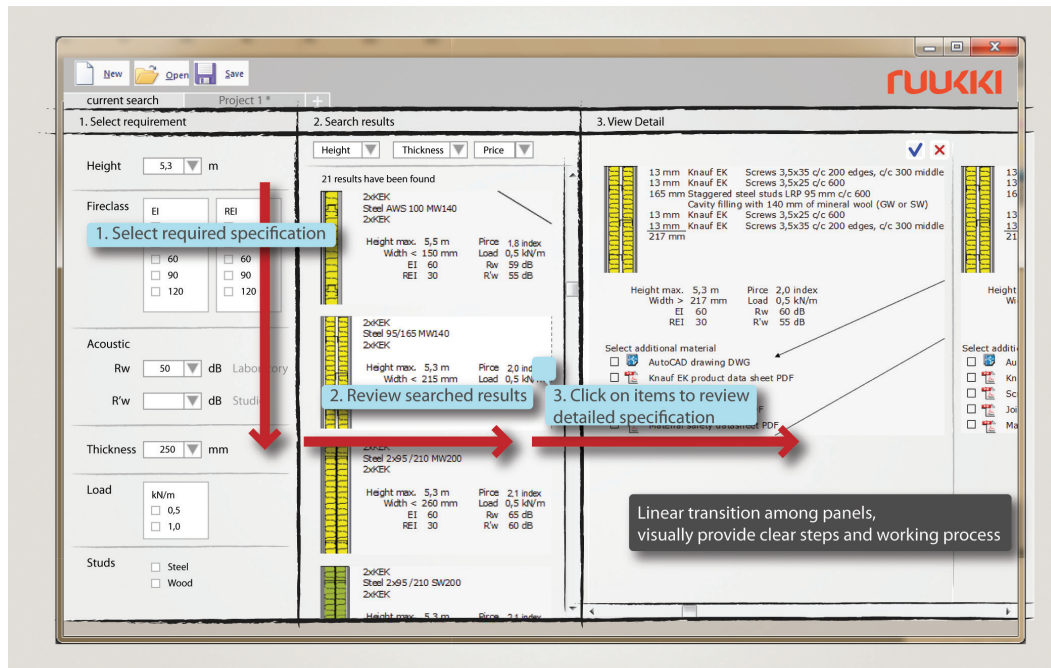


Figure 7-6 Interaction process with the application

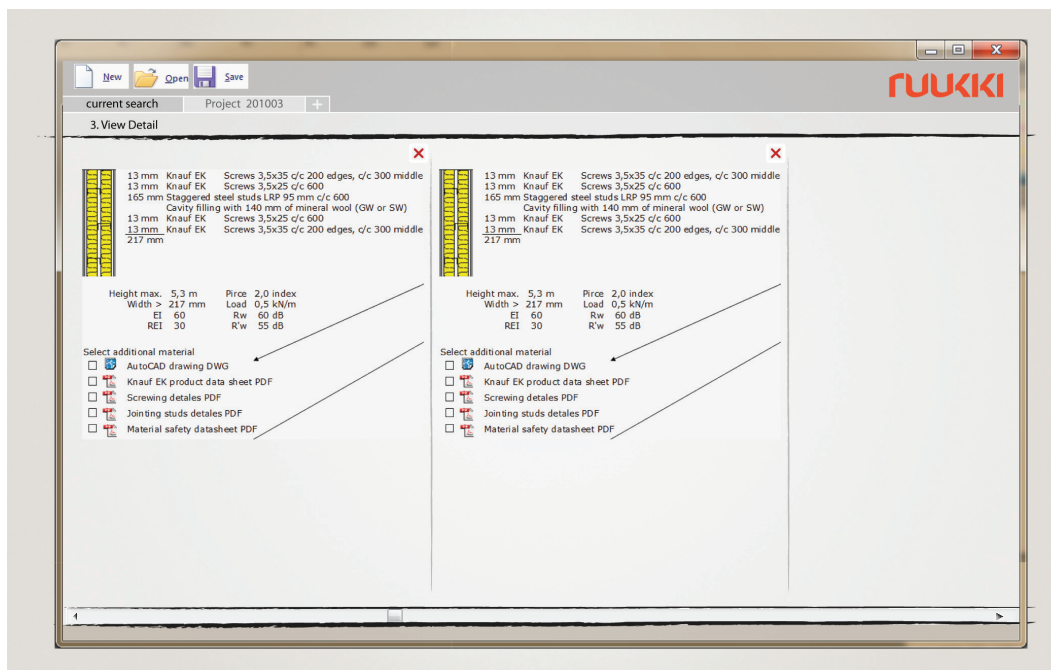


Figure 7-7 End condition of using applications

Discussion of Concept

This concept is the first design draft in the development process. It is used for discussion with different stakeholders to help developers better understand of the users' needs, and the priority of different functions. It also helped developers consider the actual scenario of using the application, in an easy-to-understand way.

Here is the summary of the discussion prompted after presentation of this concept:

- About the workflow. Is the work process correct? What do engineers do after selecting the products? What is the iteration process right after the selection and what will it be over time?
- It is necessary to review other search results without performing the search again? Will it be necessary to save search results for future review?
- What is the proper physical size for search, search result, and detail information panels?
- What is the priority of the search criteria?
- What will the output formats be? How will the formats change depending on purpose? What will the correlated functions buttons be?
- For further development, what should the visual elements look like? How can the brand image of Knauf (or Ruukki) be incorporated?

These questions were proposed for further development of the interface of Knauf application.

7.4 Conclusion

This chapter provides a guide for creating the interaction interface of software. A well-designed interface helps to provide better user experience. This guide is constructed based on the essence of human activities, an area of study within the field of Cognitive Psychology. It introduces different methods that can be used during in the development of interaction design. Good interaction design can be achieved for Ruukki's software, if these methods are followed in a rigorous and rational manner.

8 Future Developments

The development of Ruukki's software and their design principles should take the form of an iterative circle, whereby each stage represents incremental refinements of the projects. This process is based on the life cycle of design processes depicted in Human-Centered Design Processes for Interactive Systems (ISO/IEC. 13407 1999). Through findings from user studies and the evaluation of current applications, the Design Principle of Ruukki's Software should be applied in a dynamic manner to match the ever-evolving characteristics of modern business and technology. However, the main focus should always be the users, their individual working processes, the context of their work, their colleagues, and their businesses.

An illustration of different layers of Ruukki Software is displayed below. The development of Ruukki Software comprises three main layers: value system interaction, technology installation, and interaction design. Each layer has different levels of significance and contribution to the business of Ruukki and different levels of difficulty of implementation. To wisely and strategically begin the development or update of software applications, these issues and design principles must be considered.

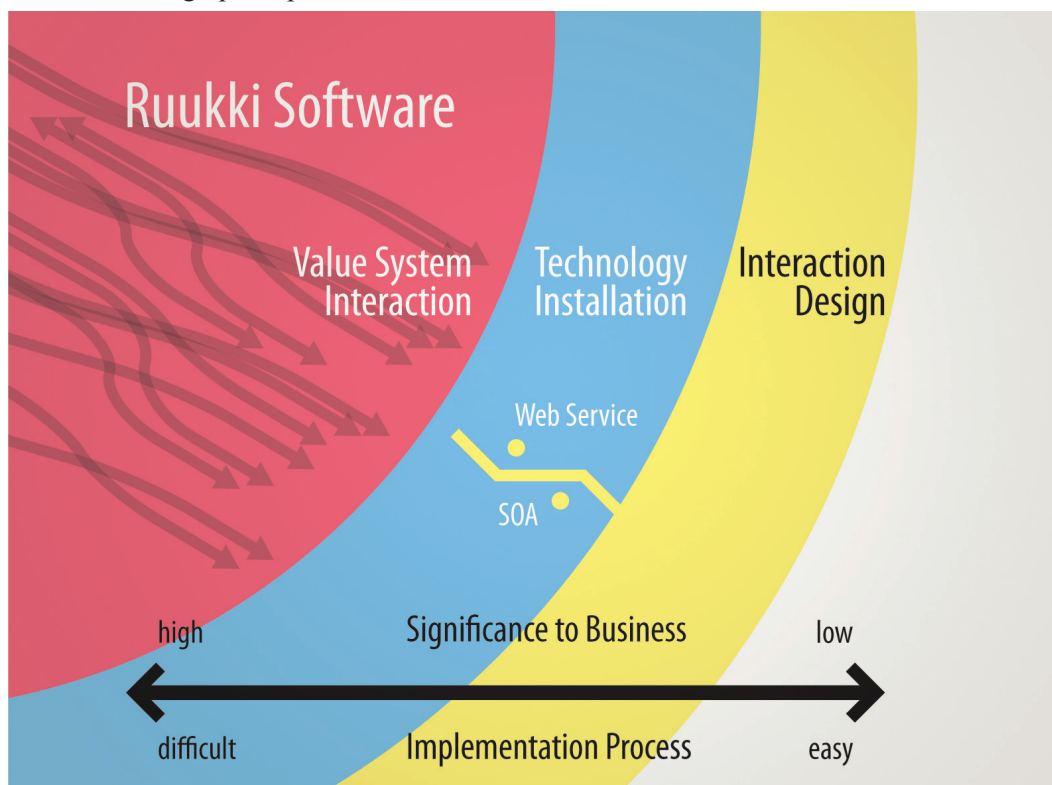


Figure 8-1 The Illustration of layers for developing Ruukki Software

PART C. CONCLUSION

9 Conclusion

This thesis demonstrates a design approach for developing user experience of software applications to indicate how to improve customer experience in the construction industry. The software applications shown in this thesis are based on a case study for Ruukki. The original task was to reinvigorate the user interface of Ruukki's software. Instead of exploring visual elements and graphic design, it aims to deliver a comprehensive solution: a design guide. The design guide will be incorporated into the software development process of Ruukki. The new image for Ruukki's software will address many of the challenges that they currently face in the business sector.

The focus on user experience is based on Ruukki's customers, active members of the building design and construction industry. The customer experience is linked to the context of the user's work; this includes the goals they hope to achieve; the tasks they have to accomplish; their working process; their interaction with colleagues; and the working relationships between all groups involved in building projects. Through the user study, contextual data can be revealed and constructed into a broader picture. It exhibits the interactions between personnel, the interactions between user and software, and the interactions between business entities.

Following a user study, there are three steps that can be followed to transform user data into a positive user experience: strategy, technology, and interaction design, as shown in the *Design Guide of Ruukki's Software*. Regarding the strategy, Ruukki's software is the enabler and supporter of business-to-business interactions. To enhance customer experience, software development should aim to mediate the value co-creation process of Ruukki and its customers. Specifically, software will help customers complete their tasks, achieve their goals, enhance interaction between different workers, and connect the business operations between Ruukki and its customers.

By using Internet technologies like Web Service and Service-Oriented Architecture, a conceptual model can be created that helps Ruukki's software to follow the strategy. The main idea of this model is that software's functions are developed as discrete services. Through the Internet technology of WSDL, SOAP, and UDDI, functions can be aggregated into specific applications that can be accessed through multiple platforms, and can share interoperable digital data. With this infrastructure, Ruukki's software is able to offer building products and customer service as a holistic solution delivered to customers. This will have a great benefit during business-to-business interactions. Furthermore, it reduces the overlaps of development resources inside Ruukki, and lowers the requirement of re-education and training for Ruukki's customers.

The third step is to develop human-centered interaction as the face of Ruukki's software. The principle of developing interaction design is that it focuses on the working process of individuals, and combines contextual data of actual working environment, partners, their relationship and the sharing information. The principle also considers the nature of human activities, goals, intentions, and actions. Interaction design is achieved through a series of steps; (1) a user study; (2) analysis and interpretation of results; (3) creation of a persona; (4) analysis of tasks; (5) creation of a framework for the interface of the software. Through

this development process, it will provide a consistent and coherent interface for Ruukki's software to enhance its user experience.

To conclude, this thesis has identified three important insights:

- 1) Inside business-to-business relationships in the construction industry, customer experience can be enhanced through emphasis on user experience during the development of software, strategy, technology, and interaction design.
- 2) The way that software and its interface improve the working process for personnel in the industry can be considered an approach to enable value co-creation processes between companies.
- 3) The basis for the first two insights is a human-centered principle. It considers people who work in the industry, their goals, their working processes, and the relationships and interactions between them. By exploring these factors through consumer studies, it is possible to provide better software and enhance customer experience.

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Appendices

Appendix A Invitation of Interview

Purpose

To identify the potentials that will gain more benefit for customers by understanding user context during the interview.

This user study is the core research of the thesis. The main purpose of this interview is trying to understand the personal context of each customer who is involved in the business of construction and architecture. The context means the individual working process, long-term and short-term tasks, working environment and related staff, personal goals and aspirations. This research is based on qualitative method: contextual interview (Cooper, Reimann, and Cronin 2007) and contextual inquiry (Beyer and Holtzblatt 1998). The data will be transformed and interpreted into useful design materials.

Context

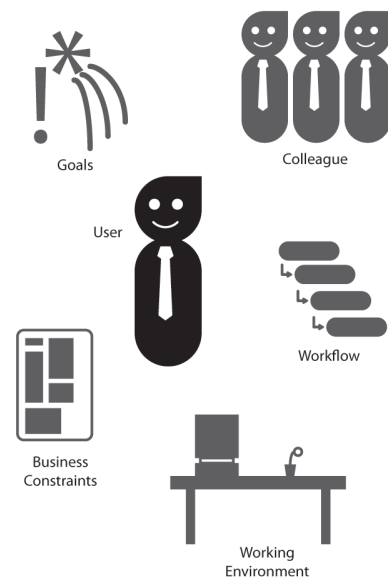
Interaction Design Guide for Ruukki's Software.

This thesis study is about creating user interface guideline for software application of Rautaruukki. A good software should be able to help user to finish their tasks effectively and efficiently. It should be under the holistic consideration of personal context and business mission. The interaction design plays an important role of software development in order to achieve the aforementioned value.

Procedure

60 minutes interview in user working environment.

- 10 mins: Brief and initiation of interview
- 20 mins: Personal responsibility introduction
- 20 mins: Daily based operational process and its context
- 10 mins: Personal aspiration, avoidance, and motivation



Appendix B Guide of The Interview and The Questionnaire

Introduction

- 1) Introduce the interviewer, the process, and the using materials for the interview
- 2) Describe the supplemental information of the interview: confidential data will remain inside Ruukki, name of person or company will be anonymous in the document.
- 3) Familiarise interviewee with the style of the interview, informal question and answer, the master and the apprentice.

Interviewee's Background

- 1) Please introduce yourself, in personal context, age, educational background, etc.
- 2) Please introduce your profession. Position at present and in the past, responsibility.

The Working Process

Please to refer to your previous project or the present project.

About People

- 1) First is about people you are working with. Let's start from inside the company. Using these papers as template. Who they are. What is their responsibility?
- 2) Second, let's talk about the clients or customers side. The same questions
- 3) Let's talk about how you work with them. How you communication with each other, the method. Workflow, etc.

About Workflow

- 1) The first task you do that is related to your job every morning / the last task you do that is related to your job before you leave.
- 2) Let's count how many tasks you do in a day, normal daily base. Where they do these tasks? How much time you spend on each one? When you usually put your effort on that one? Is there any preference and special personal wisdom?
- 3) About decision making. What kind of decision you will make in your job? How often? Are they related to someone's job that we have talked before?
- 4) Tell me more about your working environment? Your desk, how big was it. What is the computer you are using? Laptop or desktop? PC or Mac? How about the input device?
- 5) Let's talk about what is the most important thing of your responsibility? What is the thing that motivates you the most? What is the thing that you are afraid of the most? If I am your new colleague, what would you tell me to help me get on the track faster?

About Software

Think about the software applications that you are using.

- 1) Here is a picture that shows the major Ruukki software application. Are you familiar

of any of those? Have you ever use them? Tell me about your general impression of them. Are they different from the major applications that your are using?

- 2) Tell me more about what kind of applications you are using nowadays. Which one you like the best, by function, or usability, or interface or so on.
- 3) How do you start to learn to use these softwares? When was it happens? Tell me more about your history with your computer skills.
- 4) What is the most rememberable moment recently about using a software application

Appendix C Transcripts of Interview

These Transcripts are documented based on the recording of the interviews. Questions were proposed as Appendix B displayed. The content will be written in the first-person-narrative style.

17.03.2010 with Pekka at the personal block, the office of engineering consultancy company

- Responsible of supporting tasks for structural engineering field, also involved in other association (Construction information association).

About people who work with you:

- I am a manager, an advisor, and an engineering development consultant.
- “Analyzing and designing software applications” are used and evaluated by couple of personnel. They are related to concrete designing, steel designing, and wood designing.
- I reports to two managers: one is head of department and one is unit manager.
- Structure Unit / Development Department: “supporting tasks” no actual building designing or engineering. A complicated matrix of organization.
- Colleagues are senior consultants and engineers who understand deeply of structural engineering field for guiding and advising other people inside the company.

steels and beams we want to use in the building.

- For example, about software, there are ones for product designing, product requirement, function requirement, detail designing, and implementing. The range of our work is situated in requirement and designing phase.

What are your tasks?

- Reading emails is the typical daily task. It is the main way for communication.
- And I am writing a lot. Official documents. Reading papers, books, websites. Trying and testing software applications. Figuring out how to use it more efficiently. Evaluating these software. I will assign other people to try by actual tasks, like calculation, and so on. Managing evaluation process.
- For construction engineering, I write guidelines, from user interface, function guideline, process guideline. How to user these application in a project.
- In the company there are people are responsible for software application development of data modeling for application like tekla, ravit, archicad, etc.
- What we do are giving guidelines for where and when people should use what kind of applications and how to use them. We currently have around 150 applications inside company. I am responsible to choose correct software for engineering and designing to help the work proceed correctly and efficiently.

- Other related working partners are working in Finnish Ministry of Employment and the Economy.
- There are two other external partners from Construction Information Association.
- My work is creating guidelines for structural engineering and related issues.
- The Finnish Association of Consulting Firms SKOL (http://www.skolry.fi/in_english) working as a project manager on developing and implementing structural engineering software.
- My terminology explanation: “Construction” means field work of construction, our company is working on planning and designing on structural engineering.
- In construction field, there are building owners, architects, structural engineer, electrical, heating, ventilation engineers, construction management, construction site field work, factory for building components.
- Ruukki is one of the partners. We worked very closely in some projects. That is why we are interested in Ruukki products and software. According our engineering needs, we can define what kind of

- Ruukki’s software are part of our applications collection.

- We will use same applications for the specific construction components even though they might be manufactured by different companies because components are standardized and have the fixed specification. Although there might be some not widely used and particular components of Ruukki that has its own application.

Describe about your working Environment:

- Physical environment: office blocks, powerful desktop computers with one monitor. I don’t prefer to use laptop since I might have to bring the work home. Quite many people here have more than one monitor for modeling and analysis. These are all Windows’ computers.

Motivation and avoidance:

- Our work involves engineering, planning, architect, massive environment, we work based on physical world, typical environment are somehow irritating we have to put them into order. It is also the motivation that people like to solve the problems.
- Sometimes, different people have different opinions that become hard to handle, but the most important thing is keeping focus to finish the task, make it done. Be task-oriented and try to work straightforward.
- In Finnish companies, people might work in the same place for long time. When they change to

other companies, it becomes the loss for previous company. So we are developing these guidelines to create a comfortable environment for people to work. Software applications have to be professional.

About software:

- I have been using WinRami, Poimu, ComSlab, ComBeam, I have been analyzing ComCol and request Ruukki for further update.
- The first impression when I look at these applications is they look professional. But when I start go deeper to try them out, they are messy since they have been implemented since 80's. They have been updated three or four times. I am familiar with the interface although I think they are old and should be improved. They are just getting old. Software application life cycle should be like 10 years. After 10 years you should renewed them totally to fit the modern needs.
- The column application is quite essential and heavily used in Finnish industry, in one company it's the second heavily used application. We would like Ruukki to update it as soon as possible.
- ComSlab we have other alternative applications. We use this in some small house projects.
- There are other applications we used on WQ-Beam.
- Applications are messy. More specifically, it means that the functionality is a mess. Terminology has been changed during these years. When we are working, there are many things affect calculation. Everytime

after it updated, it started to hide something and then get messy. Windows are not working. Sometimes there is no way to get additional information or doing additional configuration. The point is these applications are aged. Things are not in order. Every time we have to figure out again how to use them. The graphic user interface is not a problem for me. It looks clean and simple.

- In general you can say these applications still work as what they should do but somehow the focus is missing. Mostly engineers learn to use the software themselves. They like to try out and learn buy themselves. They don't read manuals, they like Linux style task-guided manuals.
- There should be clear sign to indicate the illegal area and if the material use is economy.
- Process, engineer try calculation to see if it works or not, and step by step go deeper to check all details to see if they are fitting to the design. Everything effects everything, so there are always multiple solutions for one problems. That is also why we try to create guidelines for engineer to know the steps
- Data modeling = Modeling.
- Ravit, archicad, tekla are professional. A lot of people are working behind it. For example that tekla require two year active work experience to be good at it.
- Architecture (ArchiCad) structural calculating, structural modeling.

- I like to mention one application, Finnwood. It is good. It is for wood structure design. Calculate column, beams, etc. It just released an update this year.
- The most important thing of a software application is that it works fluently, calculates correctly, following our requirements, and it is designed for professional use.

communication. With each project, we will form a project team, not everyone is involved into the same project. One partner will be in charge of one project.

- External partners are numerous depend on the size of the project. At least one representative person in each field, so there are around 10 people.
- These 10 people are involved into different field, like construction, electricity, and technical (engineers I supposed), and there are actual users in this kind of public project also.
- How I work with colleagues. There are scheduled official meeting during the project, for instance, two times per month. There are informal meetings, phone calls, e-mails, and smaller meetings with particular some of engineers. In the formal meeting we will review all the design details and make decisions. Using presentation and materials for discussion. Pictures and description texts are the basic material of presentation.
- Structural engineers collaborate with the architecture design in a pretty early stage. Architecture and other engineering design almost start at the same time.
- After design, we will "surveillance" of construction and give advice if they need some opinions and plans.

What are your tasks:

- I will check e-mails usually when I come to office around 10. Going to the meetings, preparing

23.03.2010 with Jaakko at his architect office

- Age 41, an architect

About People:

- I am working with 3 other architects and there are 2 architect students (internship or part-time I supposed). Also there is one corporative architect who works here when the project need her.
- I have been working in two other architecture companies and building construction (as a handyman).
- Architects here share responsibilities and are involved in same project of architecture.
- We have various kinds of architecture projects, mostly mid-size, public building (i.e. maximum 6,000 m2)
- There are 3 partners and one is the leader of

for them, and writing memos after meetings are common during daytime. When it's need I stay up a little longer in the office after normal working hour.

- After the formal business hours then I will have time to do the actual architecture work.
- Depends on the architecture projects, I will do some study about the topics, functions, keep up with the regulation since it is changing all the time.
- I and other architects, we could be working both together and individually, but from time to time we will come together to check what is the progress and sketch, creating ideas together.
- When working on construction drawings is the most time consuming part of the work.
- Making time tables, schedules are quite difficult. We use this time tables inside the office, it sticks everyone's schedule together. It is a difficult task to adapt the changes of the projects.
- We like to make group decisions even though sometime it's difficult to hold these discussions. But we try to aim for making decisions together with other architects.

Environments:

- The working environment: messy, open space shared with other studios. People come and ask questions, a lot of distraction.
- My desk is full of objects, I try to make some space for some project but didn't clean everything up the

often.

- Making memos of the screen and on the wall. They are representing tasks those are not finished yet. Like tasks list, I have to finish them.
- I have desktop in the office and also laptop at home, PC environment because of the software we are using. Laptop is 17" I don't bring it everywhere.
- We have net-storage so I don't have brings files everywhere
- Motivation and avoidance:
- The worst thing is when the design, the final outcome, looks bad. You can't prepare things like that to happen somehow.
- There can be all kinds of mistakes of design documents that make things go bad. Making drawings carefully and review, re-check again and again. And when we make the schedule we will make sure there is time for review the drawings. And there will be all the engineers and other people to check drawings together in big meeting.
- Architecture design work is motivating although it is small part of the daily work.
- People are different, some learn more quickly and some do slower.
- For young new architects, generally they don't know the working process and don't understand that they are one part of the building project. Sometime they over do their job and lack of understanding it's just

one part of all the work. They can't see how the work is related to others.

About softwares:

- I am not familiar to Ruukki's applications. They are for structural engineering. I haven't see they use these softwares.
- For me the software looks very technical, detailed, and exhausting. I don't want to touch these applications.
- I am using Ravit for my work and also AutoCad. I use them for most works. I have been using Ravit for 3 years. Before that I used AutoCad.
- These applications are exhausting, huge, hard to learn. It's easy to start to making. The difficult part is learn to create all the document drawings. Ravit has many automatic document generating function that is not so easy to learn.
- Now I think I know 75-80% of how to use Ravit. I don't do the document drawings that often myself.
- I have been in two day demo/introduction course for learn Ravit.
- We don't use all the functions of Ravit. It is like an huge airplane, and we only fly short distance.
- We produce DWG files as results for engineers. Somehow this isn't so efficient because we don't create 3D models.

- We explore different options when we chose to use Ravit. It was quite exciting but later we understood it was somehow difficult to learn. Other options are ArchiCad and AutoCAD. Ravit was the newest one, looks promising even though might be lacking some ArchiCAD functions. ArchiCAD works clumsy in my opinion.
- iPod and iPhone have the most impressive interface in my opinions recently. Can't remember with which application. I wish we can also use touch screen with architecture software.

31.03.2010 with Kalevi at his personal desk, engineering consultancy company

- I am a structural engineer responsible of façade (thin-layer external wall), didn't make the drawing but do calculation and analysis, generate solution for the joint of façade and wall and frame and so on.
- Telling directly what he worked, how he worked, and also how he manage to use the software program, PurCalc

Software walkthrough:

- Setting up project title, project manager, contact person, I usually don't fill out other than these.
- Dead Load: The dead load is the weight of the structure acting with gravity on the foundations

below. Snow Load, Wind Load is frequently considered.

- Thickness of the wall has official regulation and is often planned beforehand (i.e. architects and structural engineers have decided). The official requirement could have been changed during planning, designing and the construction phases. Building will be according to the regulation when the plan was approved by regulation.
- Calculation makes sure I can use this type of component in this project.
- Deflection of façade (external surface components) will affect the internal structural components like light system, intermediate wall. I have my personal professional concern about the deflection.
- Saving files and separate different pieces. When the project go forward the length of the façade
- PurCalc has been used for two years, averagely used once / 2 months, sometimes it is hard to remember everything by heart. Basically I like this program since it is quick choose what I want. I only worked with this program since most of the job are façade analysis. Wall elements.
- The license has expired once and I haven't use the program for couple of months so I have to ask the contact person of Ruukki to send me the new license to active the software program again.
- My main task is to do calculation which is very important. The result is called façade charts.

I make the main decisions, I can borrow the similar result we made previously to the new projects. I used to say that, we are building arts, which means there is new thing coming out everyday.

- We have information as starting point from architects or structural engineer inside company or other companies also. We have to understand what we need to do, what is the background, what is colour, and so one. This is my task to gain information.
- For example that a building 3000m² that will have (calculation) 260 panels and there might be 160 different panels. There are very few exactly same panels. So we have to create 160 drawings. To make these drawings maybe I can do 5 piece per day, so I can calculate how many days I will need to make the drawing. If it need to be speed up, we will need more people. 3D drawings in my opinion is the easiest way to make the process more efficient.
- Architects and structural engineers didn't know the components (façade and panel) that well, so I have to decide and try to get the information right. From making contract to when the panels are ready on site, it's 8 weeks, very short and tight schedule.
- Every project could be different but the working steps are the same. I don't know if there is anything that the application should be improved.

Assembling details. The drawings show how each single façade locate on the structure. The order tell workers how to assemble facades, where to locate them and how to attach them to the building. Before start the drawing I have to decide these thing. So this is very important after the calculation.

- I have to decide the assembling detail and evaluate if the detail is good and tell other people my decision. Workers on site can see the drawings and know how to assemble facades in the place. I create the draft and go through detail with my colleague together to create the drawing. In many case my colleague use 3D modeling program to create the proper model to match the big plan and came to me for approval. And sometimes we have to negotiate with for example people make the frames to change the detail otherwise frames and walls won't attached together.
- I will say there might be 50 ~ 60 details, and we will decide to start our work from the most common 10~15 details. Bottom middle upper, corner, then illustration of how window can put on the walls. In some building that windows is assembled in advanced in factory.
- Detail drawings will made for factories and construction site.
- We make the drawings and the assembling plans more detailed that other people will spend less time to call us to ask about everything. If the papers has been made properly and people in factory read them properly, they can do everything by them own.

03.31.2010 with Tomi at his personal desk, a engineering consultancy company

- Graduated from TKK – Machine Engineering (2000) and started working in Finnmap, Steel Structure Designing, project leading & managing.

About People:

- In our department, 1/3 of people come from machine engineering background and the others are from civil engineering and other engineering field. We work on different materials and components here. Most of the knowledge has something in common so the educational background doesn't affect the materials we work on. Maybe you can say civil engineering people have less training in dealing details of metals but that didn't affect the work here.
- 1 supervisor and 3 colleague working with me in most of the projects. Supervisor is following what I'm doing, checking if I have enough resource and time, dealing information with contractors and my colleagues. Major projects come from my supervisor, and minor projects come from other people in departments and also outside of the company.
- We use 3D structural engineering program to do modeling, Tekla. Depending size of the project, there will be different amount of colleagues working with me.
- I use my notebook to write down and managing the schedule. I will bring it with all the time.

- In a normal project, there will be an architect, my designing group, supervisor, and different engineer in the “designing group”. Clients are there but didn’t get involved during the project that often. Construction site group. Usually there is preliminary phase that we try to find out the best solution for structure. There will be a main designer working with architects (and maybe contractors) to coordinate the details. After that phase the tasks come down to people like us to work on the actual designing.
- For communication, emails, phones, and inside company I can just go and ask, outside usually by emails. In a project usually every second week will be a meeting and inside company usually is every week, we will discuss schedule and the tasks.

What are your tasks:

- In the morning, usually is checking emails and then check the task lists, make some phone calls and meet some people. Then I will start designing and doing calculation. This is an average day. The reason is when doing designing I need to acquire the necessary information first if I want to start the work. From architects, I will get autocad files, drawings, emails with some explanation. So I check emails and my notebooks to know what has been done yesterday. Doing designing is the most time consuming task.
- Last winter I had a project that designers are responsible for the designing jobs and I decide the main frame of what should be done and when should be done and so on. I prefer to create the atmosphere

they can take care of different programs.

- I have to learn of course by myself first, and also there were training course from Ruukki. I learn by doing myself and asked other people who have experience.
- In this field, you can’t be too sure about everything. You will need two or three years experience to be familiar to structure and everything.
- 3D modeling is the newest impression of my experience.
- In many applications, the document it generates contain too much information that is not so convenient. Other people have to call me all the time to understand about the documents.

09.04.2010 with Eero at an architecture office

- I have been working here for six years, graduate from TKK in 2003. Before here, I has been working in 3 different architecture studios. This is totally 15-year working experience. I started at smaller projects like houses. Then now I’m mostly working on public buildings, schools, cultural cluster, and for instance the Shanghai Expo project. My responsibility includes architecture designing and project management. Also I have done some spatial design with steel façade in Verkatehdas Cultural

that “working together.”

- We have a regular checking method, a person who is outside the project to inspect if the design is ok.
- Time is the tricky thing in my work. Some clients or people want to get some answer of their questions. Most of tasks here is easier to handle the schedule. I like to work with people, not just calculation, I like to deal with people.
- The most important thing in my work is to divide the information to others that they can work on.

About softwares:

- Doing calculation is to get the structure work in an economical way. For instance, working with Beams, I have to test loads, what kind of structure and what materials to want to use, what kind of environment the building has.
- I have been used most of the Ruukki software programs besides PurCalc.
- My first impression of Ruukki’s software is that of course there are somehow tricky. But when I got used to it, they all have similar step by step style in Ruukki programs. When I learn one, I know most of them. It is really easy to use for me. I wouldn’t say if there is anything I want it to get improved.
- First I will calculate which product profile I will choose then do 3D modeling. Usually I will have beams and columns (2 calculation programs) and Tekla.
- Depend team members knowledge that how much

center (Hämeenlinna, 2004).

What are your tasks:

- I arrived office at 9 o’clock and read emails first. Especially like the project in Shanghai demands a lot of effort because the time difference.
- The typical thing is working on some design tasks with ArchiCAD, and correcting some project plans. Team meetings are important works: 3-4 people work for same project so we have to figure out what to do and how to divide the tasks to people. Also there are many meetings in some stage of the projects with for instance engineers. Emails and telephone calls are pretty heavily used with construction site. In our office we are strict of following the projects, we dividing works into small tasks. We use project management software applications to control the time management. So normally, this will be the last task I do in a typical day. A typical working day is eight hours.
- A different day is when we are doing competition. It’s really nice that everyone is into doing competition here. We don’t count the working hours. It gives a different view comparing to the routine normal project. We have won a lot of competitions so that make this more interesting also. Designing and team meeting will take the most of the time.
- In our office, we are trying to produce all the design with archiCAD but we are also trying to use

other applications that ArchiCAD can't do, like for rendering. All kind of tools are accepted as long they are helpful in the project, like scale models. The proportion of the time that each task demands is different during different phases of a project. I work on drawings and also see what other people draw and then having small meetings. Usually 50% of time is designing. Email takes a lot of time and also meeting could take a whole day also.

About People:

- Here is a small office (or we can say all the architecture office are typically small). We will have 3 to 4 people working on a project during design phase. I will be managing the project even though we try to have democratic decisions. Then during construction stage, these 3 designers will step back and I will work with people at the site, typically 3 main people. Also there will be clients and their consultants, we are figuring out how to control the building (like decide all major factors of buildings).
- In design stage, there will be the design team and me. Then there are structural engineers, fire engineers, and acoustic engineers. Each designer is directly contact to the responsible engineer. In a typical project, how we divide the works, for instance, façade design, interior detail design, interior architecture design (furniture and so on); this is quite a easy way of dividing tasks. And each of them contacts the engineer who is related to that field. During construction phase, main architect will take care of most the works, he/her has to

understand fully of architecture planning. "The project architect" is also responsible to negotiate if there is sudden change of schedule. Of course when some deeper information is needed, then the architect previously working on this task will come to the project again. This model works quite well even in a very big project.

- In the beginning of a building project, the client, consultant, and me will work together (also with my team). We decide many things, for instance what materials will be used on façade, typically it is the major cost of a project. We work on the "the core of the building": what kind of structural concept, what will be put there, concrete, wood, or steel. So the clients and consultants are there, sometimes they will propose what we should use. Structural engineers might give some opinions of theoretically if the structure works or not. It is about theoretically thinking of big choices for structure, materials, interiors, and what would be put inside the buildings.
- The clients make their decision usually based on the money, but soon they will realize that money is not a good measurement for evaluation. So they hire consultants for helping of evaluating where is location, if wood or steel available for building materials. Like in China, steel is really cheap. So what is the wisest solution for materials and what is feasible at the site. We are taking these choices, how all the materials can work together, like how façade shouldn't affect other structures, get rusty, ... So we have a lot of information of all kind of materials how they go well together in the buildings.

- Motivation comes from architecture itself, the beauty of the building. This is plenty enough for motivation. My stubbornness is about having flexibility during project. In contrary, some people especially like structural engineers, they like to work in a straight forward way. They want to make decision right away while I think it's too early and want to explore the possibilities. Typically in Finland we make decisions very fast that the project become not flexible. It's also a motivation of having flexibility to think about the multiple options.
- Schedule quite often is negative force that we have to make final decision based on that. It's a question of management, since in reality, we never lack of time. The budget is some limit also. And I also try to be flexible of scaling our ideas.
- In a competition project, we come pretty early comparing to building projects that we come comparatively late. Basically we handle project for whole project. Like public buildings, for instance hämeenlinna project, they apply for E.U. founding, so it took a lot of time. For clients, it could last for 5 years, and for us is 1 year. In Finland that construction site should rigorously follow architecture design.

About softwares:

- Typically these pictures are displayed on my screen (architecture plan, rendering, and layout of the indoor environment). But I realized that I shouldn't show these to other people. All kinds of colour pictures

are easier for most of the people. Architecture plans are really difficult and maybe they get easier when they're printed out, but still those are only understood by architects. Clients and consultants don't want to read architecture plan. I just generate PDF for them. We exchange information with engineers by DWG, eliminate all the 3D data, and make simple plan in DWG for engineers.

- Our work, the first thing is about sketch, then bring it to ArchiCAD to create very simple drawings. It doesn't have to follow the real dimension, just a "volume-metric" models for study. We can see through these volume very quickly that should we continue with this plan. We understand the scale even from computer screen. So designers and I, we can discuss together. Then we can go to more details even down to windows, doors, and walls how they connect together. Other architecture office I worked in has other way of working. They go directly to the architecture plan drawings and not checking the volume and surroundings. Most of the details have been known so they go directly to the details. I am more interested in bigger project, since smaller projects can get boring. Surroundings is quite important and I always work according the surroundings and how the new buildings adapted to the environments.
- For clients, it will be easier if we add some texture touch on the pictures that they will understand easily about the concept. But when discussing to

engineers that we will eliminate all the details that engineers will be more willing to give their opinions. So we give space and be flexible when discuss with engineers.

- I was using AutoCAD Architecture Desktop and you can work on “building information modeling.” I started to use ArchiCAD since 4 or 5 years ago. I also just use AutoCAD to make line drawing. ArchiCAD is good for details like facades and structures. When I draw volume of the buildings, I use rhino since it is a more logical program. In ArchiCAD you don’t have to look at 3D just draw the details 2D graphic. Although ArchiCAD is good to generate all the palnning in DWG files and it’s not the most suitable for 3D modeling. Maxwell we use for rendering. In a way we flexibly use any programs that can help our project.
- In our Expo project, I use Rhino for all geometry designing. I keep working with Rhino even until the end of the project. I generate result to engineer by rhino also. We have two models, one in Rhino and one in ArchiCAD for details. Engineers use Tekla for structural engineering. But they still try to follow Rhino drawings.
- Besides all these programs, we call photoshop: photocad. Adobe suites, excels for schedules, safari for browser. Photoshop is the most brilliant program in my opinion. I started to work with computer very late. My first work in architecture studio even didn’t have computers. It’s very logical. 3Dmax is very stupid even you know there are millions of features.

Atlantis is really good also. You can’t model anything but rendering. Since I start using computer very late, I am very flexible to use all the software that can help me. Microstation is highly expertized. Ravit is tending to be difficult.

- Recently I start to use spotif, I think it’s a really good application.